

Featured Papers in Corporate Finance and Governance

Guest Editor

Stefan Cristian Gherghina



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Guest Editor

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Editorial

Featured Papers in Corporate Finance and Governance

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Amid global uncertainties and economic fluctuations, enterprises play a crucial role in fostering sustainable growth and high-quality development through innovative and responsible practices (Xin et al., 2025). However, financial constraints play a pivotal role in the business environment, restricting company growth, performance, profitability, and the efficiency of financial markets (Talalwa et al., 2025). Under such circumstances, sustainability has become integral to corporations, influencing decision-making, enhancing reputability, and ensuring long-term growth by integrating environmental, social, and economic considerations into business models and value chains (Shamsuzzoha & Fontell, 2024). As organizations acknowledge their responsibility as custodians of the environment and active contributors to societal well-being, they are increasingly integrating social and environmental considerations into their strategic objectives (ElAlfy et al., 2024).

To evaluate a company's going concern status, its ability to continue operations must be assessed. However, traditional financial models often overlook the impact of corporate governance practices, which are essential for long-term sustainability and financial transparency (Hammond et al., 2023). Hence, corporate governance has gained prominence, particularly following major scandals, due to its essential role in protecting stakeholders' rights, ensuring proper resource allocation, and managing the environmental and social impacts of corporate decisions and strategies (Estévez-Mendoza & Montoro-Sánchez, 2024). Corporate governance is a framework of trust, ethics, moral values, and confidence, formed through the collective efforts of all societal stakeholders, including the government, the public, service providers, and the corporate sector (Aras & Crowther, 2008). Corporate governance is regarded as the system and processes used to direct and manage a company's operations, with the goal of enhancing business prosperity, ensuring corporate accountability, achieving long-term shareholder value, and addressing the interests of other stakeholders (Abor & Adjasi, 2007). It ensures an effective distribution of power between shareholders and executives, promoting accountability, transparency, and stability, which are vital for a corporation's survival and the health of financial markets (Mugarura, 2016). Appointing a sound board of directors is crucial, as this shapes corporate leadership, influences the organizational culture, and impacts corporate performance, with a well-structured board driving high performance and effective oversight and a poorly organized board leading to dysfunction and potentially harming the firm's value (Rebeiz, 2016). The best governance practices foster investor confidence and enhance the firm's overall value (Singh & Pillai, 2022), playing a critical role in strengthening relationships among all stakeholders (Ahmed, 2023).

This Special Issue, "Featured Papers in Corporate Finance and Governance", comprises 25 papers covering various aspects of corporate governance, financial performance, and sustainability practices. Topics include the wealth effects of mergers and acquisitions (M&As), particularly the performance differences between cash- and stock-based transactions, and the moderating influence of horizontal M&As on credit risk in the banking sector.

The studies also explore the implications of CEO characteristics for investment efficiency, focusing on the influence of political connections and leadership styles, and investigate the relationship between risk committee characteristics, agency costs, and financial performance, with a particular emphasis on financial firms. Further discussions address the role of sustainability report assurance and corporate governance in enhancing environmental, social, and governance (ESG) scores and highlight the importance of governance structures, such as gender-diverse boards, for corporate outcomes. These studies underscore the need for effective risk communication and strategic decision-making, especially in the context of economic uncertainty and regulatory changes. Collectively, they provide valuable insights into the evolving landscape of corporate finance and governance, offering practical recommendations for enhancing corporate practices and financial performance.

Regarding wealth effects, Satapathy et al. (2025) analyzed those of cross-border and domestic M&As in India over the period from 2004 to 2019. The study examined 58 cross-border deals and 34 domestic deals, concluding that there were no significant shareholder gains and that investors were skeptical about the value-creating potential of such M&As. It was also found that advisory services stabilized returns but did not significantly enhance wealth. Cash-based transactions outperformed stock-based deals, with the firm size not influencing the outcomes of these deals. This research highlights the importance of risk management and strategic communication, particularly in cross-border M&As, where stakeholder concerns about transaction risks need to be addressed.

Jallad et al. (2025) examined the moderating effect of horizontal M&As on the relationship between credit risk and bank value using the quantiles via moments estimator. Credit risk negatively affected bank value, but this relationship was less pronounced in banks with higher market value. Horizontal M&As had a direct positive effect on bank value, albeit with a negative moderating role in reducing the unfavorable impact of credit risk. This finding has significant implications for bank management, particularly in terms of risk diversification during M&As.

With respect to the stakeholder models of state-owned enterprises (SOEs), Rissy (2025) analyzed the narrow legalistic framework of SOEs in Indonesia, emphasizing the need for a moral and legal stakeholder model to protect the interests of various stakeholders. Using doctrinal and empirical legal research methods, the study highlights that Indonesian SOEs often fail to fulfill their obligations to stakeholders due to the current legal framework's limitations and advocates for a more inclusive stakeholder approach to ensure better governance and accountability within SOEs.

In terms of sustainability report assurance within corporate governance, Handayati et al. (2025) investigated its role in enhancing environmental, social, and governance (ESG) scores in Indonesian firms. Firms with assured sustainability reports had higher ESG scores, suggesting that third-party assurance enhances the credibility of sustainability reports. Additionally, the gender diversity of boards did not have a significant impact on ESG scores, but the presence of sustainability committees positively influenced ESG performance. The study underscores the importance of robust corporate governance practices, including the implementation of board committees, in promoting sustainability goals.

Concerning financial performance during mergers and acquisitions, Dogan and Ugurlu (2024) focused on target companies in the UK, examining their liquidity, profitability, and asset management before and after the transaction. Cash acquisitions tended to lead to better financial outcomes than non-cash acquisitions, especially in terms of the short- and medium-term liquidity and profitability. Low-value acquisitions were also more likely to benefit liquidity and profitability, emphasizing the potential for value creation with smaller deals.

With respect to dividend policy and its relationship with leverage and profitability, Akpadaka et al. (2024) explored this in manufacturing firms across Nigeria and South Africa. Nigerian firms faced greater financial constraints, with high leverage negatively impacting dividend payouts, whereas South African firms were more flexible in their dividend policies. Profitability also moderated this relationship in Nigeria, allowing firms to sustain dividend payments despite high leverage.

Shaheen et al. (2024) examined the impact of CEO characteristics, particularly political connections, on investment efficiency in Jordanian firms. Older CEOs tended to make more balanced and less aggressive investment decisions, while younger CEOs exhibited more efficient decision-making by investing in high-growth projects. Furthermore, political connections were found to reduce the likelihood of under-investment but encouraged over-investment, especially when coupled with older or family CEOs.

Regarding employee equity compensation and pension obligations, Klumpes (2024) analyzed the relationship between these factors, focusing on how they impact a firm's cost of capital. Pension risks had a more complex relationship with firm risks than was previously thought, and pension benefit obligation (PBO) measures led to higher cost of capital estimates than more restricted accumulated benefit obligation (ABO) measures. This research highlights the importance of accounting for pension risks when estimating a firm's cost of capital.

Le et al. (2024) studied the link between CEO pay disparities, insider trading activity, and CEO turnover in the US. Large pay gaps between CEOs and their employees reduced the likelihood of CEO dismissal, particularly when insiders were buying stock, indicating entrenchment behavior. On the other hand, insider stock sales signaled an impending CEO departure, suggesting that investor actions reflect perceptions of a CEO's performance.

Regarding executive pay disparities and insider trading activity, Nguyen et al. (2024) examined how these affect stock returns prior to earnings announcements. Larger pay gaps between executives and their employees were associated with higher returns from insider purchases before positive earnings disclosures, while a high pay disparity reduced the returns from insider sales before negative earnings news was received. This highlights the role of governance in shaping insider behavior and market reactions.

With respect to risk disclosure and readability, Moussa and Elmarzouky (2024) investigated the relationship between these in the annual reports of non-financial UK firms. Increased risk disclosure led to more readable reports, with COVID-19 disclosures strengthening this relationship. The study emphasizes the importance of clear and transparent risk communication, especially in times of crisis, to ensure that stakeholders can make informed decisions.

Abdul-Kareem et al. (2024) focused on optimizing insolvency prediction models by balancing data and selecting the most relevant features for prediction. A Multi-Layer Perceptron (MLP) model combined with Particle Swarm Optimization (PSO) outperformed traditional methods in terms of speed and efficiency, providing more accurate predictions of financial insolvency.

Salikhova et al. (2024) studied how corruption levels and minority shareholder protection influence corporate debt decisions in various countries. In more corrupt countries, firms tended to take on more debt to shield assets from political risks. Moreover, firms in countries with stronger minority shareholder protection took on more debt, a finding that was more pronounced in developed countries.

Concerning ESG performance, Gidage et al. (2024) explored how this affects a firm's sensitivity to systemic risk (SR). Better ESG ratings helped to reduce a firm's exposure to systemic risk, as firms with high ESG ratings tended to attract more loyal consumers and

stable investors. Factors like the firm size, age, and borrowing costs also affected how ESG improvements impacted risk sensitivity.

Regarding corporate governance practices, Rahman et al. (2024) analyzed how these influence earnings quality and idiosyncratic risk in Pakistan. Strong governance practices and a higher earnings quality reduced the idiosyncratic risk, underscoring the importance of effective corporate governance in managing financial risk and enhancing firm stability.

Al-Nimer et al. (2024) investigated the relationship between the capital structure, liquidity risk, and profitability in Jordanian banks. A strong capital structure reduced the liquidity risk and improved profitability and operational efficiency. This research emphasizes the importance of optimal capital structure management in mitigating liquidity risk and enhancing financial performance.

Gharios et al. (2024) analyzed the relationship between board characteristics, such as gender diversity and independence, and corporate profitability. Gender diversity and board independence positively impacted profitability, while the board size and meeting frequency had no significant effect. These findings underscore the importance of diverse and independent boards in fostering better financial outcomes.

In relation to the impact of risk committee characteristics in financial firms, Almulhim et al. (2024) found that independent and expert risk committees were effective in reducing agency costs and improving financial performance. However, larger committees were found to increase agency costs. This highlights the need for well-structured risk committees to enhance firm performance.

Persakis and Tsakalos (2024) examined how economic uncertainty influences audit quality, particularly how the amount of power wielded by a CEO moderates this relationship. Economic uncertainty negatively affected audit quality, but this effect was less severe in firms with more powerful CEOs, indicating that strong leadership can help maintain audit quality in uncertain times.

Concerning the financial performance of state-owned enterprises (SOEs), Wibowo et al. (2024) found that Indonesian SOEs suffer from lower profitability and liquidity compared to private firms, primarily due to inefficiencies in capital management. The study calls for improved liquidity management and debt restructuring to enhance the financial performance of SOEs.

Cheng et al. (2024) explored the impact of a CEO's regulatory focus on corporate social responsibility (CSR) and firm performance in US firms. CEOs with a promotion-focused regulatory style tended to lead firms with lower CSR engagement, which negatively impacted firm performance. However, CEO equity compensation was found to mitigate the negative impact of a promotion-focused regulatory style.

Athanassakos (2024) explored how CEOs' asset allocation skills affect firm stock returns. CEOs with stronger asset allocation skills, especially those following value-investing strategies, led firms with superior stock performance, highlighting the importance of effective asset management in boosting firm value.

With respect to non-CEO top management team (TMT) turnover, Chulkov (2024) analyzed its impact on firm decisions and performance. Turnover among non-CEO TMT members often signaled poor investment decisions, as it was associated with the increased reporting of discontinued operations and extraordinary items. The study suggests that non-CEO TMT turnover can help prevent the escalation of commitment to failing projects.

Concerning the influence of financial indicators on sustainability reporting practices in Vietnam, Anh et al. (2024) found that leverage was negatively correlated with the quality of sustainability reports, while asset turnover and returns on equity positively affected the report quality. The study suggests that firms should integrate both financial and non-financial metrics to improve the quality of sustainability disclosures.

Examining CFO-related research contributions and their limitations, Rashid et al. (2024) provided a review of CFO research using a bibliometric analysis, highlighting the need for more research looking beyond the role of the CEO to that of the CFO. The authors identified key limitations in CFO research and suggested future directions to improve the understanding of CFOs' responsibilities and their influence on firm performance.

The papers included in this Special Issue provide an in-depth and insightful exploration of the evolving relationship between corporate governance, financial performance, and sustainability practices. Covering a wide array of topics—from mergers and acquisitions to CEO characteristics and ESG performance—these studies highlight the critical role governance plays in shaping corporate strategies and long-term success. The findings offer valuable directions for future research, encouraging further examination of how effective governance can drive sustainable growth, enhance stakeholder value, and contribute to responsible business practices in an ever-changing global landscape.

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Article

The Influence of Financial Indicators on Vietnamese Enterprise's Sustainability Reports Disclosing Process

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Abstract: Sustainability reporting has become increasingly crucial for businesses worldwide, communicating environmental, social, and governance (ESG) performance to stakeholders. Despite the growing importance of sustainability reporting, there remains a gap in understanding how financial indicators influence the disclosure process, particularly in Vietnamese enterprises. This paper aims to address this gap by investigating the influence of financial indicators on the sustainability reporting practices of Vietnamese companies. Employing a mixed-methods approach, combining a quantitative analysis of financial data with a qualitative assessment of sustainability reports, the research seeks to uncover the nuanced relationship between financial performance metrics and the quality and extent of sustainability disclosures. The research was conducted to identify, evaluate, and measure financial factors affecting the quality of companies' sustainability reports in Vietnam. The research is based on scoring the sustainable development reports of the top 100 listed joint stock companies on the HOSE—Ho Chi Minh City Stock Exchange. Based on the research model of Dissanayake, in the case of Vietnam, we build a scoring model for the sustainable development report based on GRI standards and add additional criteria appropriate to the situation of each listed company on the Vietnam stock exchange. Based on the research overview, our team tested hypotheses related to the short-term current ratio, total asset turnover ratio (AT), return on equity ratio (ROE), and debt-to-equity ratio (DE). The empirical results show that the AT and ROE significantly positively affect the sustainability reports; the DE hurts the sustainability reports. The findings are expected to provide valuable insights into the factors shaping sustainability reporting practices in Vietnam and contribute to the existing literature on corporate disclosure and sustainability.

Keywords: sustainability report; financial indicators; GRI standard; return on equity

1. Introduction

Sustainability reporting has gained increasing recognition as a critical tool for businesses worldwide to communicate their environmental, social, and governance (ESG) performance to stakeholders. While extensive research has been conducted on sustainability reporting in various contexts, there remains a notable gap in the literature regarding the specific influence of financial indicators on sustainability reporting practices among Vietnamese enterprises. In this regard, Vietnam serves as a compelling case study, representing a developing economy experiencing rapid economic growth and industrialization. As one of Southeast Asia's most dynamic emerging markets, Vietnam faces unique socioeconomic and environmental challenges, including rapid urbanization, industrial pollution, and resource depletion. Against this backdrop, sustainability considerations take on heightened significance to promote responsible business practices and as a catalyst for inclusive and sustainable development.

Despite the growing importance of sustainability reporting globally, there is a dearth of empirical research examining the determinants and dynamics of sustainability reporting practices within the Vietnamese context. Given Vietnam's transition towards a market-oriented economy and increasing integration into the global supply chain, understanding how financial indicators influence sustainability reporting processes is paramount for businesses, policymakers, investors, and other stakeholders. This study seeks to address this gap by investigating the influence of financial indicators on Vietnamese enterprises' sustainability reporting practices. By analyzing the relationship between financial performance metrics and the extent and quality of sustainability disclosures, the research aims to provide insights into the factors shaping sustainability reporting practices in Vietnam. Furthermore, by contextualizing sustainability reporting within Vietnam's broader socioeconomic landscape, this study aims to contribute to the academic literature and the practical efforts towards sustainable development in Vietnam and other developing economies facing similar challenges. The study underscores the relevance and importance of examining sustainability reporting practices in this context by emphasizing Vietnam's significance as a representative example of a developing country undergoing rapid economic transformation. This approach strengthens the contribution aspect of the research by highlighting its potential implications for sustainable development efforts in Vietnam.

In corporate reporting, sustainability reporting has become a pivotal tool for organizations to convey their commitment to sustainable development and responsible business practices. However, while extensive research has been conducted on sustainability reporting globally, there is a notable gap in the literature regarding the specific influence of financial indicators on the sustainability reporting processes of Vietnamese enterprises. This study aims to address this research gap by examining how financial metrics impact the sustainability reporting practices of Vietnamese companies. By investigating this relationship, the research seeks to answer fundamental questions about the interplay between financial performance and sustainability disclosures in the Vietnamese context. Ultimately, this research endeavors to shed light on the factors driving sustainability reporting in Vietnam and contribute to the broader understanding of corporate disclosure practices (Chen et al. 2024; Chowdhury et al. 2024; Dahinine et al. 2024; Deng et al. 2024). In today's era, the phrase "Sustainable Development" appears more and more in the annual reports of businesses around the world, and they increasingly focus on the transparent disclosure of non-financial information, like the impact of business activities on society and the environment, instead of just paying attention to economic efficiency. According to the Vietnam Business Council for Sustainable Development, the sustainability report measures, publishes, and holds businesses accountable to stakeholders for their activities aimed at sustainable development. In the sustainability report, businesses develop and publish information about their performance on environmental and social aspects, in addition to information about their financial and management performance capital value. There are 268 listed companies in Vietnam, of which 148 (accounting for 55.5%) have published sustainable development reports. The problem is a significant increase compared to 2020, when only 97 companies (accounting for 36.2%) published this report. Publishing a sustainability report is a step forward. It is essential to enhance the social responsibility of Vietnamese businesses.

Regarding studies related to sustainability issues, although there have been many studies around the world on this issue in the past, the studies are only in developed countries and are relatively few in developing countries. They are developed, while most countries worldwide, including Vietnam, are currently developing countries. Because research on sustainability issues is not popular and focused on Vietnam, the grass-roots research topic "Overview of financial indicators affecting the sustainability reporting activities of listed companies in Vietnam" has theoretical and practical significance (Doleac et al. 2024; Eldomiaty et al. 2024; Enck et al. 2024).

This study will score the Sustainability Reports of the top 100 listed companies on the HOSE—the Ho Chi Minh City Stock Exchange. In the case of Vietnam, we built a

scoring model for the Sustainability Report based on GRI standards. We added additional criteria suitable for each company listed on the Vietnam stock exchange. Theoretically, the project will build a theoretical framework, generalize, and fully systematize the Sustainability Report, the Sustainability Report scoring model, and calculate the indicators of financial statements that are believed to affect the company's sustainability issues in the last three years, thereby drawing accurate conclusions about their relationship and influence on the Sustainability Report. In practical terms, the study will use the Sustainability Report scoring model built based on Global Reporting Initiative (GRI) standards to draw up the main criteria and evaluate the quality of these reports (Ernst and Woithe 2024; Filgueiras et al. 2024).

From the above analysis, our team decided to conduct scientific research on the impact of each financial index on the Sustainability Reports of companies listed on the Vietnam stock market in the updated period from 2020 to 2022, thereby also providing more information to investors and stakeholders and, at the same time, providing recommendations to businesses, helping businesses further improve their Sustainability Reports.

2. Literature Review and Hypothesis Development

2.1. Sustainability Report

2.1.1. The Definition of Sustainability Report

According to the research conducted by (Anh et al. 2024), the sustainability report is a valuable information channel for enterprises and stakeholders about three essential aspects of a company: economy, society, and environment. In addition, relating to the research of Bogdan et al. (2023), sustainability reports are designed to systematize and disseminate quantitative and qualitative information on sustainable business issues, encouraging engagement and providing transparency to all stakeholders (Khémiri et al. 2024; Khezri et al. 2024; Lee and Kim 2024).

Although the sustainability report has demonstrated and emphasized the responsibility of companies and businesses to society, it still has some shortcomings. Transparency in corporate social responsibility disclosure on sustainability reports worldwide remains largely involuntary and unaudited, with research verifying the validity of the information provided (Bui et al. 2023). Ding et al. (2023) argue that managers' interests often drive sustainability reporting and may use false information or misleading details to bring about personal benefits for themselves or the company they currently work for (Duong and Vu 2023).

2.1.2. The Classification of the Sustainability Report

Numerous companies in this article prefer using GRI standards to publish their corporate sustainability report. According to Firoiu et al. (2023a), GRI is an international, non-profit organization that provides a comprehensive and understanding sustainability reporting standard that can be widely used by all companies worldwide (GRI standards). In 2017, the Ho Chi Minh City Stock Exchange and foreign partners launched the Vietnamese version of GRI standards, the latest version of which is GRI4. GRI standards are organized into four categories: general, economic, environmental, and social. Some GRI standards are formulated and quantified to help enterprises and stakeholders calculate statistics easily and comply with the criteria mentioned in the GRI standards set (Anh et al. 2024).

Applying GRI standards' assessment criteria has improved the evaluation quality of an enterprise's social responsibility and sustainability development efforts in its annual sustainability report. Utilizing GRI standards with quantitative and qualitative methodologies helps enterprises comprehensively and precisely understand the current problem. It enables them to prepare and conduct appropriate solutions to address these issues (Anh et al. 2024).

Besides GRI standards, companies also use other standards to disclose sustainability reports, for example:

The SASB—Sustainability Accounting Standards Board: a US non-governmental organization created to help investors have a more general view of the operating situation, opportunities, and risks that a company may encounter in the short or long term.

The 17 sustainable development goals announced by the UNSDG—United Nations Sustainable Development Goals are a list of goals that need to be met based on topics related to dignity, people, the planet, partnership, justice, and prosperity. These goals are designed to improve the quality of human life, protect the environment (water, soil, and trees), and prosper in the distant future.

Standards related to sustainability issues are published by the International Standards Organization (ISO), such as ISO 2600, which deals with social responsibility and is used in conjunction with GRI reporting. In addition, many other ISO standards target sustainability goals, such as environmental management (ISO 14001), medical device quality (ISO 13485), and occupational health and safety (ISO 45001) (Lee 2024; Liu et al. 2024; Mo et al. 2024).

2.1.3. Important Principles to Demonstrate Content Stated in the Sustainability Reports

According to the Vietnam Ministry of Finance, there are three essential principles to follow in the sustainability report, including the following:

Principle of stakeholder consultation: This principle requires enterprises to identify their stakeholders and explain how they meet relevant parties' reasonable expectations and interests. Stakeholders' expectations and interests help the firms make appropriate decisions in the reporting process (Mohammed et al. 2024; Neacșu and Georgescu 2024).

Principle of sustainable development context: This principle requires reports to illustrate the performance of enterprises in the appropriate context of sustainable development. Information about performance results must be demonstrated in a particular context. This issue includes discussing the organization's performance in the context of resource, environmental, and social constraints and demands at the industry, local, regional, or global level.

Materiality principle: This principle requires that sustainable development reports include areas that reflect the significant economic, environmental, and social impacts of the enterprise or affect the assessment and decisions of the enterprise and relevant parties. Relevant topics have reason to be considered necessary for reflecting the economic, social, and environmental impacts on the enterprises or influencing the decisions of relevant parties, so it is likely to be included in the report.

The sustainability reporting process requires businesses to consider the interests of stakeholders, individuals, or groups of people who may be affected by the business's operations in some way. Stakeholders include employees, customers, partners, suppliers, NGOs, communities, investors, government, and the media. Sustainability development reports significantly add value to an enterprise's reputation and business capabilities by building trust with various stakeholders (Nematirad et al. 2024; Ribeiro et al. 2024; Vendramini et al. 2024).

2.1.4. The Process of Evaluating Sustainability Report

Measuring the quality of a sustainable development report is a complex and relative task because a sustainable development report is multidimensional, and businesses choose different methods and standards to publish information. In previous research and documents on measuring the quality of sustainability reports, numerous methods have been applied and followed up by many researchers. Firoiu et al. (2023b) counted the number of characteristics, sentences, and pages that mentioned or were related to sustainable development to calculate how many percentages appeared in the document. This method is easy to implement and suitable for businesses with a small amount of published information. However, this approach is prone to errors; the results are not comprehensive and can be one-sided (Grigorescu et al. 2023). They have created a sustainability report score model based on the criteria they desire to audit those companies. In addition, the research used the statistics from a third-party company, Hexun.com, for their research. All the meth-

ods mentioned above have been used widely by numerous researchers. However, some methods are not suitable for Vietnamese companies. For instance, third-party companies in Vietnam cannot easily approach statistics companies if they decide not to publicize them, so researchers will have difficulty looking for appropriate statistics that might be used in their research. In addition, the demand for assessing sustainability reports in Vietnam is skyrocketing. Employers, stakeholders, and the government are concerned about the actions and campaigns the company conducts relating to sustainable development so each party can assess the efficiency of the sustainable development process in these enterprises and take proper actions. For example, the government can rely on sustainability development reports to prevent the company from discharging untreated waste directly into the environment and encourage the firm if it assures corporate social responsibility. Due to these reasons, our research group decided to build a scoring model to assess the sustainable development process of companies, especially Vietnamese companies. Our research group hopes this model can tackle issues from previous methods and is simple enough for Vietnamese companies to apply and follow up quickly.

2.2. Hypothesis Development

2.2.1. Current Ratio

The current ratio is a financial ratio that measures a business's ability to pay short-term debt. Companies with high levels of solvency or liquidity are considered capable of managing their business, resulting in low levels of risk. This issue demonstrates the image of a trustworthy company, which creates a positive and strong image associated with the company. It will have better financial sources to invest in sustainable development activities, such as environmental protection and community development (Vuong et al. 2021).

According to Mohammed et al. (2024), companies with high liquidity levels can quickly pay short-term obligations on time. According to the stakeholder theory, a company with a high level of liquidity means it is in a better financial position, consolidating a favorable and trustworthy image of the company to the stakeholders, which eventually encourages the enterprise to improve the quality of the information in the sustainability report when they disclose to their stakeholders. In addition, research conducted by Thu and Xuan (2023) shows that liquidity ratios positively affect the publication of sustainability reports, which means that ratios belonging to the liquidity group, such as current ratios, have no impact on the frequency or the quality of sustainability reporting. From the above foundations, the authors build the following hypothesis:

H1: *A company's current ratio positively affects the quality of sustainability reporting.*

2.2.2. Total Asset Turnover (AT)

Asset turnover is a financial indicator that measures the efficiency of using a business's assets. The higher this index, the better the business's asset utilization efficiency. Businesses with good asset utilization efficiency will have fewer assets to generate one revenue unit. This problem shows that businesses use assets effectively, saving costs and having more financial resources to invest in sustainable development activities. In previous research articles, there have been studies on the impact of sustainable development reporting on asset turnover (Nga et al. 2023). They examined the impact of sustainability reporting on the financial performance of public companies in terms of asset management ratios. The results of the study show that sustainability reporting has a significant impact on improving asset management ratios. In the existing literature, empirical evidence suggests a significant positive relationship between sustainability reporting and financial performance metrics such as return on equity (ROE) and total asset turnover (AT), suggesting that companies with robust sustainability practices tend to achieve better financial outcomes. However, the directionality of this relationship remains a subject of debate, and the potential endogeneity between sustainability reporting and financial indicators necessitates further investigation.

This study examines the impact of financial indicators, including profitability, liquidity, and leverage, on sustainability reporting practices among Vietnamese enterprises. By adopting a regression analysis approach, the research model aims to assess the causal relationship between financial indicators and sustainability reporting (AT → sustainability reporting) while controlling for potential endogeneity issues. While prior studies have predominantly explored the influence of sustainability reporting on financial performance (sustainability reporting → AT), the current study seeks to complement this literature by investigating the reverse relationship. By examining how financial indicators drive sustainability reporting practices, this research aims to provide valuable insights into the mechanisms underlying corporate disclosure decisions and their implications for sustainable development in Vietnam (Wang and Liang 2024; Yen et al. 2021).

H2: *The AT positively affects the quality of sustainability reporting.*

2.2.3. ROE and Leverage

A financial metric called return on equity (ROE) means how well a company uses its equity capital. The higher this index rises, the more effectively the business uses equity capital. Investors will contribute more to a firm when they think it is worth it. This problem will enable the company to raise money and financial resources, boosting operating efficiency and a return on equity. Businesses with a high return on equity (ROE) will be more inclined to invest in sustainable development initiatives and improve national and global sustainable development metrics. Conversely, companies with poor ROE will find it challenging and risky to implement sustainable development (Yokoyama et al. 2024).

Using the Global Reporting Initiative methodology, Paudel et al. (2023) examined the scope and factors influencing sustainability performance disclosure provided by Kazakhstan's publicly traded enterprises. They discovered a positive correlation between all reporting factors and the ROE variable, which serves as a stand-in for profitability.

At the 5% significance level, they discovered that all sustainability reporting factors positively correlated with the ROE variable, which measures profitability. Alternatively, according to research conducted by Yokoyama et al., which investigated how ROE affected the sustainability reports of Sri Lankan listed businesses, the model's findings demonstrated that ROE significantly improved the sustainability report's quality. However, a study on the return on equity conducted by (Radmehr et al. 2023) revealed that ROE has no bearing on the standard of the sustainable development report.

H3: *ROE has a positive effect on the quality of sustainability reporting.*

H4: *Debt to equity ratio or leverage hurts the quality of sustainability reports.*

3. Methodology

3.1. Data Analysis Method

3.1.1. Data Collection

Based on the synthesis and inheritance of theories from previous research, the research team collected secondary data from reputable sources, including the company's annual report, sustainability report, and financial statements for the top 100 listed companies on the HOSE in the three years from 2020 to 2022. Data collected from Vietstock.vn, an online financial information portal, named Route No. 1, in Vietnam. The data of the companies selected for sampling were complete for use in the research process.

The research model for regression is presented in Equation (1) as follows:

$$Y = B_0 + B_1CR + B_2AT + B_3ROE + B_4DE + E_{i,t} \quad (1)$$

In which Y: sustainability report score; CRs: current ratios; AT: total assets turnover; ROE: return on equity; DE: debt to equity ratio.

3.1.2. Sustainability Reporting Scoring Model

Table 1 presents the sustainability reporting scoring model mentioned earlier; the research team built a scoring model for the sustainability report as follows:

Table 1. Sustainability reporting scoring model.

Criteria	Score				
	0 (Lowest)	1	2	3	4 (Highest)
Experience	Does not include any disclosures or reports in any year	NA	Includes disclosures or reports in the current year	Includes disclosures or reports from at least three years ago	Includes disclosures or reports for at least three years ago and the current year
Format	There are no formats	Sustainability disclosures of one or fewer pages containing details of sustainability/CSR activities carried out by the company	Notes within two pages (including details related to sustainability issues or activities related to corporate social responsibility)	Notes within 3–4 pages (including details related to sustainability issues or activities related to corporate social responsibility)	The sustainability report must consist of more than five consecutive pages, and the title “Sustainability Report” is not adequate
CEO statement	Does not include sustainability initiatives in the CEO statement	NA	NA	NA	Declaration of sustainability initiatives in the CEO statement in the annual report itself or within the sustainability report/disclosures
Stakeholder focus	Does not include any stakeholder group	Includes one stakeholder group	Includes two stakeholder groups	Includes three stakeholder groups	Includes more than four stakeholder groups
Sustainability aspects	No sustainability aspects are included	NA	One sustainability aspect is included	Two sustainability aspects are included	Three sustainability aspects are included
Sustainability goals	Does not include sustainability goals in the current year or future years	NA	NA	NA	Includes sustainability goals in the current year or the future years
Sustainability goal achievement strategy	Does not include any methods or any means of achieving the listed goals	NA	NA	NA	Includes methods or any means of achieving the listed goals
GRI guidance	Does not follow the GRI guidelines or any other standard	NA	NA	Follows other standards	Follows the GRI guidelines

Table 1. Cont.

Criteria	Score				
	0 (Lowest)	1	2	3	4 (Highest)
GRI index (n/k)	0%	1–25%	26–50%	50–75%	75–100%
External assurance	Does not seek external verification	NA	NA	NA	External verification of the sustainability report by a third party

Source: authors.

3.1.3. Measurement Method

After collecting the data, the research team processed and selected the collected data. First, the team collected data on six financial indicators in the annual reports of 100 businesses in 2020–2022. At the same time, through the annual reports, the group collected information on sustainable development based on the criteria that the group stated in the sustainability reporting scoring model. After the data selection was complete, the team proceeded to process the data through quantitative research methods. The quantitative research method was carried out by processing the collected data using STATA 17 and SPSS 25 software. Specifically, the research team performed the FGLS (feasible generalized least squares) regression model to check the impact of each financial index on the quality of the BCPTB of the top 100 companies listed on the Vietnam stock exchange during the research period. From there, the group analyzed and discussed the results and concluded to complete the research objectives.

3.2. Sample Selection

This study's primary data collection was carried out. The main goal of obtaining proper permissions for research equipment was to gather the required data. For this study, the research team focused on research with a scope of six financial indicators in the annual reports of the top 100 listed companies on the HOSE—the Ho Chi Minh City Stock Exchange—online under the State Securities Commission and the management of the Vietnam stock exchange for a period of three years, from 2020 to 2022. At the same time, through the annual reports, the group collected data according to the following criteria: sustainability criteria that the team introduced in the sustainability reporting scoring model, thereby creating an additional variable for each company's total points of the sustainability report.

3.3. Analysis Procedures

3.3.1. Descriptive Statistical Analysis

Descriptive statistical analysis describes the essential characteristics of the collected data and provides an overview of the research sample. Descriptive statistics in this study show the average value, max value, min value, and standard deviation of the variable's current ratio (CT), total asset turnover ratio (AT), return on assets ratio (ROA), return on equity ratio (ROE), debt on equity ratio (DE), and earning per share (EPS) of businesses listed on the Vietnam stock market in the period 2020–2022.

3.3.2. Correlation Analysis

Table 2 present the correlation analysis results. Correlation analysis is applied to test the nexus between variables in the model. From there, we can predict the effects of the independent parameters on the dependent variable and the multicollinearity phenomenon. The statistical index correlation coefficient (r) expresses the degree of correlation between variables. This coefficient varies in the range $[-1, 1]$. According to (Salman and Ismael

2023), the linear relationship between variables can be estimated through the correlation coefficient value.

Table 2. (a) Correlation analysis results. (b) The correlation of the independence variables in the model.

(a)				
r value	Relationship between variables			
$r > 0$	The two variables have a positive relationship			
$r < 0$	The two variables have a negative relationship			
$r = 0$	The two variables do not have a linear relationship			
$ r = 1$	Absolute linear correlation			
$ r = 0.6\text{--}0.8$	Robust linear correlation			
$ r = 0.4\text{--}0.6$	There is a linear correlation			
$ r = 0.2\text{--}0.4$	Weak linear correlation			
$ r < 0.2$	Linear correlation is very weak, or there is not a linear correlation			
(b)				
	CR	AT	ROE	DE
CR	1			
AT	−0.0334	1		
ROE	−0.0028	0.1124	1	
DE	−0.0666	−0.0094	0.3421	1

Sources: compiled by author.

If there is a difference in the impact trend of the independent and dependent variables between the results of the correlation analysis and the results of the regression model, at that time, the regression model may not fully meet the hypotheses of the research model.

3.3.3. Regression Analysis

The regression analysis model measures the effects of independent variables on the dependent variable. The prob coefficient (p -value) of the regression analysis results indicates the level of impact of the independent variables on each dependent variable. Commonly used levels of statistical significance are 1%, 5%, and 10% (or, in other words, 99%, 95%, and 90% confidence levels).

The regression analysis is performed in the following order:

Stage 1: Selecting fixed-effect and random-effect models. We use the Hausman test with a hypothesis.

- H_0 : A random-effect model is appropriate.
- H_1 : A fixed-effect model is appropriate.

If the Hausman test gives a p -value greater than 0.05, the random-effect model is appropriate, and vice versa; if the p -value of the Hausman test is less than 0.05, the fixed-effect model is appropriate.

Stage 2: Compare the model selected in step 1 and the pooled OLS model to choose the optimal model:

If step 1, select REM. The research team uses the White test when comparing the pooled OLS model with the REM method. If the p value < 0.05 , then the REM model is suitable.

If step 1, choose FEM. Comparing the model using the pooled OLS method with the FEM method, the author uses the F test in the FEM model. With a p -value < 0.05 , the FEM model is suitable.

Stage 3: Check the defects of the model selected in step 2. Testing for heteroscedasticity: in this study, our team uses testing for heteroscedasticity using the LM test (command test 0) with the following hypothesis:

- Ho: The model has no heteroscedasticity.
- H1: The model has heteroscedasticity.

If the p -value of the test is more significant than 0.05—accept the Ho hypothesis (the model does not have heteroskedasticity); on the contrary, if the p -value is less than 0.05—the model has heteroskedasticity.

Testing for autocorrelation: in the study, our team tested for autocorrelation using the Wooldridge test with the hypothesis:

- Ho: The model has no autocorrelation.
- H1: The model has autocorrelation.

With the p -value of the Wooldridge test greater than 0.05—accept the hypothesis Ho (the model does not exist for autocorrelation); on the contrary, if the p -value is less than 0.05—autocorrelation exists.

4. Results and Discussion

4.1. Descriptive Statistics

Using the chart to comment on the overall sustainability reporting score, we found a distribution range where the lowest score was 0 and the maximum score was 36. Five businesses reached the maximum score for sustainability reporting. Out of all the organizations surveyed, 5% had the highest sustainability reporting score of 36, while 3% of the companies did not receive any score at all. A summary of the data reveals that most businesses received between 22 and 36 points for their sustainable development reports. The typical standard score attained by businesses, which make up 30% of all the enterprises polled, was 18 points. Figure 1 presents the Vietnam stock exchange's top 100 listed businesses' sustainability reporting as follows.

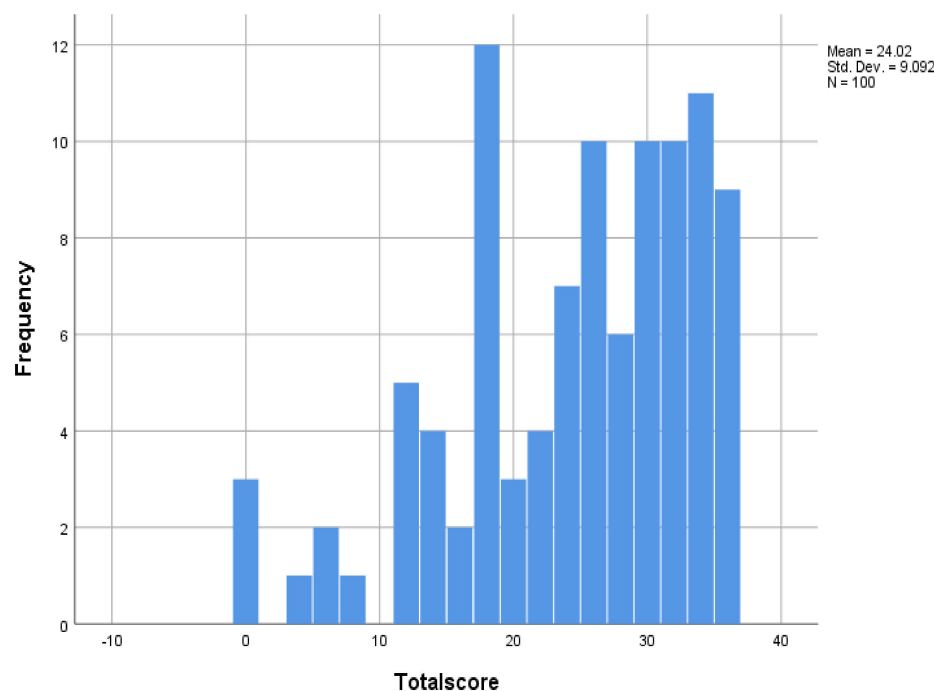


Figure 1. Vietnam stock exchange's top 100 listed businesses' sustainability reporting.

It is clear that the experience component, which receives an average score of 3.48 out of 4, has the highest average score among the criteria used to grade sustainable development

reports. The following two areas, “sustainable development reporting format” and “strategy to achieve sustainable development goals”, have average scores of 3.26 and 3.29 points, respectively. With an average score of just 0.36 out of 4, the “external assurance” element receives the lowest overall rating. Table 3 presents the scoring criteria for sustainability reports as follows.

Table 3. Scoring criteria for sustainability reports.

	Number of Cases	Mean	Standard Deviation	Minimum Value	Maximum Value
External Assurance	100	0.36	1.150	0	4
Stakeholders	100	2.78	1.554	0	4
CEO Statement	100	2.48	1.951	0	4
GRI Standard	100	2.48	1.951	0	4
Sustainable Targets	100	3	1.741	0	4
Experience	100	3.48	1.087	0	4
Format	100	3.29	1.233	0	4
GRI Index	100	0.91	1.342	0	4
Sustainable Strategies	100	2.36	1.977	0	4
Sustainability Aspects	100	3.26	1.021	0	4
Total	100	24.2402	9.092	0	36

The “Sustainability Aspects” grading criterion, which we have established, is based on how many sustainability aspects a business publishes to grade its sustainable development report. The environmental, economic, and social dimensions of sustainability are the three that were discussed. The data table shows that a steadily declining number of businesses are announcing fewer sustainability-related features. Moreover, 52 businesses (52%) out of the 100 that received a score reported all three sustainability dimensions. In their reports on sustainable development, one-third of businesses (33%) revealed two sustainability-related factors. Ten (10%) and five (5%), respectively, are the amount of companies that have disclosed one feature and none. Furthermore, 95% of businesses are concerned with sustainability in some capacity. Table 4 presents the scoring criteria for “Sustainable Aspects” as follows.

Table 4. Scoring criteria for “Sustainable Aspects”.

	Frequency	Percentage
Zero aspects	5	5.0
One aspect	10	10.0
Two aspects	33	33.0
Three aspects	52	52.0
Totals	100	100.0

4.2. Other Tests

4.2.1. Heteroskedasticity Test

According to the results of Table 5, when testing for heteroskedasticity, we see that $\text{chibar}^2(01) = 171.45$ with a p -value of $0.0000 < 0.05$, proving to reject H_0 and accepting the hypothesis of heteroskedasticity in this model. Table 5 presents the result of the heteroskedasticity test below.

Table 5. The result of the heteroskedasticity test.

Model	Dependent Variable	Prob > chi2	Conclusion
	BV	0.0000	The model has heteroskedasticity

4.2.2. Durbin–Watson Test

In the study, the research team tested autocorrelation using the Wooldridge test with the hypothesis:

When testing the hypotheses about autocorrelation through the Wooldridge test, the results in Table 6 are $F(1, 95) = 0.585$ and $p\text{-value} = 0.4462 > 0.05$, meaning they can be accepted. Hypothesis H0 and the model do not have autocorrelation. Table 6 presents the result of the autocorrelation test as follows.

Table 6. The result of the autocorrelation test.

Model	Dependent Variable	Prob > chi2	Conclusion
	BV	0.4462	The model has no autocorrelation.

4.3. Fixing Model Defects

The regression results are presented in Table 7 as follows.

Table 7. The regression results of the study.

	Coefficient	<i>p</i> -Value
Current Ratios (CRs)	−0.082	0.164
Asset Turnover (AT)	0.012 **	0.013
Return on Equity (ROE)	0.347 ***	0.001
Leverage or Debt-to-Equity Ratio (DE)	−0.215 ***	0.001
_Cons	0.5889 ***	0.000

, * represent 5%, 1% significance, respectively. (Source: computed by authors using STATA 17.0).

4.3.1. Current Ratio Analysis

Liquidity—Unlike expectations, liquidity was not associated significantly with sustainability reporting practices. The coefficient estimate for liquidity was $\beta = -0.082$ ($p > 0.05$), suggesting that liquidity levels did not significantly influence the extent of sustainability disclosures among Vietnamese enterprises. Based on the empirical results of testing hypothesis 1, a p value of 0.164 was obtained, more significant than $\alpha = 0.05$. Therefore, the results of this study did not support H1. Hypothesis 1 was rejected. This suggests that changes in CR do not significantly affect changes in sustainability reporting. From the results of this analysis, we do not find statistically significant evidence of the relationship between the current ratio and the quality of the level of SR disclosure in both positive and negative aspects. We find that companies with high levels of solvency or liquidity are considered capable of managing their businesses, resulting in low levels of risk. A highly liquid company is a company that has succeeded in paying short-term obligations promptly. However, the regression results show no relationship between CR and SR quality. This issue complements previous research conducted in which investors did not use additional information on social and environmental activities contained in sustainability reports as a reference to financial statements when providing loans to companies. Investors look at a company's health more from its financial statements than its sustainability report, so liquidity does not influence the release of its sustainability report. This problem shows us that investors and creditors in Vietnam do not care about sustainable development reports when lending money to a company.

4.3.2. Assets Turnover (AT) Analysis

Based on the tests performed, a p value of 0.013 was obtained, which was less significant than $\alpha = 0.05$. Thus, the results of this study supported the second hypothesis. Hypothesis 2 was accepted. This suggests that changes in AT significantly affect the changes in the sustainability report. From the results of this analysis, we find statistically significant evidence of the relationship between the total asset turnover ratio and the quality of SR disclosure on the positive side. We found that this index is one of the indicators that directly affects a business's profits and revenue. AT provides information about a business's ability to generate revenue from its assets. A high AT can be a sign that a business is managing its assets effectively, leading to revenue and profit growth, which all businesses want. However, the regression results show that there is a positive relationship between AT and the quality of SR. This issue can be explained by the fact that businesses emphasize economic efficiency, and economics is also one of three factors in the sustainability triangle model. Therefore, managers always want to beautify their company's financial statements. Meanwhile, according to research by Son et al. (2023), the total asset turnover index harms financial statements; that is, when a business increases its total asset turnover, this will increase its financial risk. Although this index is essential, it is equally risky, so businesses will be sensitive to it and consider using it to consider sustainability.

4.3.3. ROE and Liquidity Analysis

Regression Analysis—Regression analyses examined the relationship between financial indicators and sustainability reporting practices among Vietnamese enterprises. Three vital financial indicators were considered: profitability, liquidity, and leverage. **Profitability**—The regression analysis revealed a statistically significant positive relationship between profitability and the extent of sustainability disclosures. Companies with higher profitability tended to disclose more information on environmental, social, and governance (ESG) factors in their sustainability reports. The coefficient estimate was $\beta = 0.347$ ($p < 0.05$), indicating that a one-unit increase in profitability was associated with a 0.347-unit increase in the extent of sustainability disclosures, holding other variables constant. Based on the empirical results of testing hypothesis 3, a p value of 0.001 was obtained, less significant than $\alpha = 0.05$. Therefore, the results of this study support the H3. Hypothesis 3 is accepted. This suggests that changes in ROE significantly influence changes in the sustainability report. From the results of this analysis, we find statistically significant evidence of the relationship between ROE and the quality of the level of SR disclosure in positive aspects.

The higher this index, the better the company's efficiency in using equity capital. When investors believe in the value of a business, they are willing to invest more, helping the business increase its capital and financial resources, thereby improving operating efficiency and ROE. Businesses with high ROE have more resources and motivation to invest in sustainable development activities, thereby improving the country's and the world's sustainable development indicators. However, the regression results show the relationship between ROE and SR quality. This issue is similar to previous studies by Thu et al. (2022) when they argue that the ROE variable, representing profitability, is positively associated with all sustainability reporting variables. This problem can be explained by the fact that while ROE depends on the components of operating efficiency, capital structure, and risk, the quality of sustainability reporting depends on the sense of social responsibility of the business. These factors can act independently or affect each other, making the relationship between ROE and sustainability reporting quality complex and challenging to predict. A business with a high ROE may not have high-quality sustainability reporting if that business focuses on short-term profitable activities without paying attention to sustainability issues; for example, short-term cost-reduction measures, such as cutting environmental or personnel costs, may be used. These measures can help businesses improve ROE but reduce sustainability reporting quality.

Leverage—The regression analysis also found a significant negative relationship between leverage and the extent of sustainability disclosures. Companies with higher leverage ratios tended to disclose less information on ESG factors. The coefficient estimate was $\beta = -0.215$ ($p < 0.01$), indicating that a one-unit increase in leverage was associated with a 0.215-unit decrease in the extent of sustainability disclosures, holding other variables constant. Hypothesis 4 was accepted.

Correlation Analysis—Correlation coefficients were calculated to assess the strength and direction of the relationships between financial indicators and sustainability reporting variables. Profitability or ROE exhibited a moderate positive correlation with the extent of sustainability disclosures ($r = 0.347$, $p < 0.01$). Liquidity showed a weak negative correlation with sustainability disclosures, although the correlation was not statistically significant ($r = -0.082$, $p > 0.05$). Leverage or the debt-to-equity ratio demonstrated a moderate negative correlation with sustainability disclosures ($r = -0.215$, $p < 0.01$). **Content Analysis**—Content analysis of sustainability reports revealed variations in the quality and extent of disclosures across different companies and industries. While some companies provided comprehensive disclosures covering a wide range of ESG factors, others had limited or superficial disclosures, particularly regarding social and governance aspects. **Comparative Analysis**—Comparative analysis with international standards and practices highlighted similarities and differences in sustainability reporting practices among Vietnamese enterprises compared to companies in other countries. Vietnamese companies generally lag regarding the depth and breadth of sustainability disclosures, particularly in governance-related areas.

Case Studies—Case studies of selected Vietnamese enterprises provided qualitative insights into the motivations, challenges, and strategies influencing sustainability reporting practices. Companies with strong corporate governance structures and a clear commitment to sustainability tended to have more robust reporting practices. **Sensitivity Analysis**—Sensitivity analyses were conducted to test the robustness of the results, confirming the stability of regression coefficients and correlation coefficients under different specifications and data transformations. Overall, the results suggest that profitability positively influences sustainability reporting practices among Vietnamese enterprises, while leverage negatively impacts the extent of disclosures. Liquidity, however, did not significantly affect sustainability reporting. These findings provide valuable insights for businesses, policymakers, and stakeholders seeking to enhance sustainability reporting practices in Vietnam.

Alternative Specifications—Conduct robustness checks by employing alternative specifications of the regression models. This issue may include using different functional forms, such as log-linear or quadratic specifications, to test the sensitivity of results to model specification. **Control Variables**—Include additional control variables in the regression models to account for potential confounding factors. Variables such as firm size, industry type, and ownership structure can be included to control their influence on sustainability reporting practices.

Sub-Sample Analysis—Perform sub-sample analyses to assess whether the relationship between financial indicators and sustainability reporting varies across different subsets of the data. For example, separate analyses can be conducted for small versus large companies or companies operating in different industries. **Bootstrapping**—Employ bootstrapping techniques to assess the robustness of regression coefficients and test for the stability of results under different samples. Bootstrapping generates multiple random samples from the original dataset and calculates regression coefficients for each sample, allowing for the estimation of confidence intervals and hypothesis testing.

Building on the logic of stakeholder expectations, regulatory pressures, and strategic considerations, the hypothesis posits that financial indicators significantly influence the extent and quality of sustainability disclosures among Vietnamese enterprises, even after controlling for other relevant factors. By elucidating the causal relationship between financial indicators and sustainability reporting and addressing potential omitted variable

bias, this study aims to contribute to the existing literature on corporate disclosure and sustainability in emerging economies. The revised introduction strengthens the study's methodological rigor and theoretical foundations by acknowledging the need for control variables, emphasizing their importance in mitigating omitted variable bias, and incorporating them into the research model. This approach enhances the credibility and robustness of the empirical findings, ensuring a more comprehensive understanding of the relationship between financial indicators and sustainability reporting practices in Vietnam. Robustness check: we used the FMOLS estimators to ensure that the DOLS estimation was consistent. Table 8 presents the models' estimators FMOLS values.

Table 8. The results of FMOLS-dependent value LnSR.

Source				Number of Obs	=300
				Prob > F	=0.0000
				R-squared	=0.9630
				Adj R-squared	=0.9823
				$p > t $	
Ln SR	Coef.	Std. Err.	T		
Ln CR	−0.079 *	0.0132	−6.65	0.000	
Ln AT	0.015 ***	0.0025	3.98	0.001	
Ln ROE	0.359 ***	0.0122	6.23	0.000	
Ln DE	−0.218 ***	0.0932	−5.82	0.001	
_Cons	−11.38 ***	25.8391	−8.61	0.000	

*, ***, represent 10%, 1% significance, respectively. (Source: computed by Stata 17.0 software).

Robust Standard Errors—Use robust standard errors in regression analysis to account for potential heteroscedasticity or autocorrelation in the data. Robust standard errors provide more reliable estimates of coefficients and standard errors, especially when the assumptions of classical regression analysis are violated. **Outlier Analysis**—Conduct outlier analysis to identify and assess the influence of outliers on the regression results. Outliers may distort the estimation of coefficients and standard errors so that sensitivity analysis can be performed with and without outliers to evaluate their impact on the findings.

Cross-Validation—Employ cross-validation techniques to assess the predictive performance of the regression models. Cross-validation involves splitting the data into training and testing sets and evaluating the model's performance on the testing set to ensure its generalizability and robustness. By incorporating these robustness checks, the reliability of the study's initial findings can already be further validated, enhancing the credibility of the study's results.

4.4. Discussion

Compared to previous studies, this research addresses several notable gaps and differentiates itself in the following way. **Focus on Vietnamese Enterprises**—While there is a considerable body of the literature on sustainability reporting and its determinants, many studies have predominantly focused on Western contexts or larger emerging markets. This study explicitly targets Vietnamese enterprises, filling a significant gap in the literature by providing insights into sustainability reporting practices within the Vietnamese business environment.

Integration of Financial Indicators—Previous studies have often explored the determinants of sustainability reporting independently from financial indicators. This research uniquely investigates the influence of financial metrics on sustainability reporting practices, recognizing the interconnectedness of financial and non-financial performance in shaping corporate disclosure strategies.

Mixed-Methods Approach—While some studies have employed quantitative analysis or qualitative assessments separately, this research adopts a mixed-methods approach, combining quantitative analysis of financial data and qualitative evaluation of sustainability reports. By integrating multiple research methods, this study offers a comprehensive

understanding of the relationship between financial indicators and sustainability reporting practices.

Nuanced Examination of Relationship—Previous research has provided insights into the determinants of sustainability reporting. However, it often lacks a nuanced examination of how financial indicators influence the quality and extent of sustainability disclosures. This study aims to bridge this gap by conducting a detailed analysis of the interplay between financial performance metrics and sustainability reporting practices, offering insights into the underlying mechanisms driving corporate disclosure decisions in the Vietnamese context.

Contextualization within Emerging Markets—While some studies have explored sustainability reporting in emerging markets, few have examined the Vietnamese context. This research contributes to the literature by contextualizing sustainability reporting practices within Vietnam's unique socioeconomic and regulatory environment, offering valuable insights for businesses operating in similar emerging market contexts.

Cross-sectoral analyses are essential for understanding how the relationship between financial indicators and sustainability reporting practices may vary across different industries. This is how we can incorporate cross-sectoral analyses into the study: **sector-specific regression analysis**—conduct regression analyses separately for different sectors or industries within the Vietnamese economy. This approach allows for a more nuanced understanding of how the relationship between financial indicators and sustainability reporting may differ across sectors. We should analyze the coefficients of financial indicators (profitability, liquidity, and leverage) in each sector to identify any sector-specific patterns or differences in the influence of financial metrics on sustainability disclosures.

Comparative Sector Analysis—Compare the extent and quality of sustainability reporting across different sectors to identify sector-specific disclosure practices and trends. We should assess whether specific sectors prioritize certain ESG factors over others in their reporting based on their specific business models, supply chains, and stakeholder expectations. **Case Studies Across Industries**—Include case studies of companies representing various industries to provide insights into sector-specific challenges and opportunities related to sustainability reporting. We should explore how companies in different sectors approach sustainability reporting, considering regulatory environments, market dynamics, and competitive pressures. **Industry-Specific Stakeholder Perspectives**—Gather perspectives from industry stakeholders, including industry associations, trade unions, and consumer advocacy groups, to understand sector-specific priorities and expectations regarding sustainability reporting. We should incorporate stakeholder feedback into the analysis to contextualize the findings and provide a more comprehensive understanding of sector-specific dynamics. **Policy Recommendations Tailored to Industries**—Develop policy recommendations tailored to different industries' specific needs and characteristics. For example, industries with high environmental impact may require more stringent reporting requirements and incentives for sustainability initiatives. We should consider sector-specific challenges and opportunities when designing regulatory frameworks, incentive mechanisms, and capacity-building initiatives to promote sustainability reporting practices. By integrating cross-sectoral analyses into the study, we can better capture the diversity of sustainability reporting practices across industries and tailor policy recommendations to address sector-specific needs and challenges. This approach enhances the relevance and applicability of the research findings for stakeholders in various sectors of the Vietnamese economy.

Indeed, earnings management practices are well documented in the literature and are often employed by companies to manipulate financial results to meet certain stakeholder expectations, including those of investors. This phenomenon can affect the relationship between financial indicators and sustainability reporting practices. This is how we can address this aspect in the study:

Earnings Management Considerations—Acknowledge the possibility of earnings management in interpreting financial indicators such as profitability (e.g., return on

equity—ROE) and its potential impact on sustainability reporting practices. We should discuss how companies may strategically manage their earnings to influence financial metrics such as ROE, which could indirectly affect their incentives for sustainability reporting. **Robustness Checks for Earnings Management**—Conduct robustness checks to assess the potential influence of earnings management on the relationship between financial indicators and sustainability reporting. We should include additional control variables or alternative measures of financial performance that account for potential manipulation of earnings to ensure the robustness of the results. **Qualitative Insights into Reporting Motivations**—Incorporate qualitative insights from interviews, surveys, or case studies to explore the motivations behind companies' sustainability reporting practices, particularly about earnings management concerns. We should probe into whether companies strategically leverage sustainability reporting as a mechanism to mitigate the negative perceptions associated with earnings management or to signal their commitment to long-term value creation. **Stakeholder Perspectives on Reporting Integrity**—Gather perspectives from various stakeholders, including investors, analysts, and regulatory authorities on the perceived integrity and reliability of sustainability reporting in the context of potential earnings management practices. We should explore stakeholders' expectations regarding the transparency, accuracy, and disclosure quality of sustainability reports and how companies can address concerns related to earnings management.

Policy Implications for Reporting Integrity—Discuss policy implications to enhance the integrity and credibility of sustainability reporting, considering the challenges posed by earnings management practices. We should propose regulatory measures, enforcement mechanisms, and disclosure requirements that promote transparency and accountability in sustainability reporting, thereby mitigating the incentives for earnings management. By addressing the phenomenon of earnings management and its potential implications for sustainability reporting practices, the study can provide valuable insights into the complex interplay between financial indicators, stakeholder expectations, and reporting integrity in the Vietnamese context. This nuanced understanding can inform policy interventions and corporate governance practices to foster transparency, trust, and sustainability in corporate reporting.

Overall, this study contributes to the existing literature by offering a focused examination of the influence of financial indicators on sustainability reporting practices within Vietnamese enterprises, employing a mixed-methods approach to provide a comprehensive understanding of this relationship and filling significant research gaps in the field. Creating a sustainability report model generally follows the appropriate guidelines. It is supported by specific sets of sustainable standards, including the GRI standards or the development goals issued by the United Nations.

To find the relationship between the publication of sustainable development reports and positive changes in financial indicators, the research team divides the report into different groups of indexes to understand all aspects of the report. The research team decided to build a list of 13 social responsibility reporting indexes with four contents corresponding to four main aspects of the sustainability report: vision and strategy, economy, environment, and society to adapt to the demands of different parties and help enterprises address issues in the sustainable development disclosure process.

In this research, the shortage of data and the incomplete regulatory system are also factors that hinder the assessment of the relationship between financial indicators and the quality of the sustainable development report in Vietnam. The results of this study show a need for coordination between relevant parties, including businesses, governments, and investors, to improve the quality of sustainable development publications. Enterprises need to pay more attention to sustainability development factors in business operations and disclose the sustainable development report wholly and transparently. Management agencies need to complete and improve the system of regulations and standards on sustainable development reports to ensure uniformity and effectiveness. The relationship

between financial indicators and the quality of sustainability report publication in Vietnam is complex. It needs to be further researched for a more accurate and complete assessment.

Expanding the policy implications section to include discussions of the results from the perspectives of various stakeholders can provide a comprehensive understanding of the implications for different actors involved. There is a need to elaborate on the policy implications:

Government and Regulators—The findings suggest that profitability positively influences sustainability reporting practices among Vietnamese enterprises. Policymakers may consider incentivizing sustainable practices by offering tax breaks or subsidies to companies that demonstrate firm commitments to ESG principles in their reporting.

Given the significant negative relationship between leverage and sustainability disclosures, regulators could introduce mandatory disclosure requirements for highly leveraged companies to enhance transparency and accountability in reporting. This issue could mitigate risks associated with financial instability and promote sustainable business practices. **Corporate Sector**—Companies with higher profitability are more likely to engage in sustainability reporting. Corporate leaders should recognize the business case for sustainability and integrate ESG considerations into their strategic decision-making processes. By aligning financial and non-financial performance goals, companies can enhance their long-term value creation and stakeholder trust.

Businesses must invest in capacity building and stakeholder engagement to improve the quality and comprehensiveness of sustainability disclosures. Engaging with investors, customers, employees, and communities can provide valuable insights into the ESG issues that matter most to stakeholders, guiding companies in prioritizing their reporting efforts. **Investors and Financial Institutions**—Investors play a critical role in driving corporate sustainability by allocating capital to companies demonstrating strong ESG performance. The findings underscore the importance of considering financial indicators alongside sustainability disclosures in investment decision-making processes. Investors should demand greater transparency and accountability from companies, encouraging them to disclose relevant ESG information that can inform investment decisions. Financial institutions, including banks and asset managers, should incorporate sustainability considerations into their risk assessment and lending practices. By assessing the sustainability performance of borrowers, financial institutions can better identify and manage ESG-related risks, ultimately contributing to more sustainable and resilient financial systems.

Civil Society and Non-Governmental Organizations (NGOs)—Civil society organizations and NGOs play a crucial role in advocating for corporate accountability and promoting sustainable development. They can leverage the findings of this study to advocate for more robust regulatory frameworks and corporate governance mechanisms that support sustainability reporting practices. NGOs can also collaborate with businesses to build capacity for sustainability reporting and facilitate multi-stakeholder dialogues on ESG issues. By fostering collaboration and knowledge-sharing, civil society organizations can help drive positive change towards more responsible and transparent business practices.

In conclusion, the policy implications of this study underscore the need for concerted efforts from governments, businesses, investors, and civil society to promote sustainability reporting and integrate ESG considerations into decision-making processes. By aligning financial incentives, regulatory frameworks, and stakeholder engagement strategies, stakeholders can work together to foster a more sustainable and inclusive economy in Vietnam.

5. Conclusions

In conclusion, this study has explored the influence of financial indicators on the sustainability reporting practices of Vietnamese enterprises, filling a significant gap in the existing literature. Using a mixed-methods approach, the research has provided valuable insights into the relationship between financial performance metrics and sustainability disclosures. The study has identified key factors shaping sustainability reporting practices in Vietnam through rigorous analysis, contributing to a deeper understanding of corporate

disclosure dynamics in emerging markets. Moving forward, the findings of this research can inform corporate stakeholders, policymakers, and researchers about the importance of integrating financial and non-financial metrics in corporate reporting practices to promote sustainable development in Vietnam. In recent decades, there has been an increased emphasis on sustainability, especially in business behaviors. Companies and investors emphasize maintaining and enhancing the sustainability triangle's environmental, economic, and social facets. An instrument used by businesses to inform, establish, and affirm their commitment to stakeholders about their business initiatives is the sustainable development report. Concerns about the sustainability report's publication quality are also growing. As time passes, an increasing number of sustainability reporting standards have been implemented to assist companies in raising the quality of their reports. "Although there are still many points that need improvement, it is hoped that reporting quality will develop sustainably in the future with positive changes in the disclosure of sustainable development information of businesses in the 2023 reporting season as well as increasingly stricter international regulations along with increasing pressure from institutional investors", stated Mr Nguyen Viet Thinh, General Director of CGS Vietnam and Head of the Sustainable Development Report Voting Team. We will see more advancements in best practices and improved methods in the upcoming years.

The study's contribution was to create a model and award a score to the sustainability reports of the top 100 Vietnamese stock exchange listed businesses for the 2020–2022 triennial period. We identified the financial variables from the assessments that impact the quality of sustainability reports released by listed firms. The relationship between AT and ROE, two entirely new and unpublished indicators, has been studied. The results show that leverage or debt-to-equity ratios (DEs) and the publication quality of sustainability reports are negatively correlated. Moreover, a correlation exists between AT, ROE, DE, and the quality of sustainability report publications. Similarly, we found no correlation between the current ratio (CR) and the quality of sustainability report publications. These findings have formed the basis of our suggestions for management teams, corporations, and investors to raise the caliber of sustainability reports by sharing information about company sustainability to increase awareness and knowledge about the company's behaviors.

Nonetheless, there are still some restrictions on this study. Due to temporal and budgetary limitations, the research team's data sample comprised only a subset of the companies. The only market it applied to was Vietnam. In addition, this study did not consider other factors that may affect the quality of the sustainability report, such as the external characteristics of the companies, such as government intervention and the scale of the companies. Thus, future research groups can conduct this study with larger domestically and internationally sample sizes to make the findings more broadly relevant. Furthermore, future studies should explore how other factors, such as government intervention, may influence the standard of releasing the companies' sustainability reports.

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Article

Turnover by Non-CEO Executives in Top Management Teams and Escalation of Commitment

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Abstract: This article investigates the relationship between the decision-making bias known as escalation of commitment and the turnover of non-CEO executives in top management teams. The phenomenon of escalation of commitment is observed when decision makers persist with business investments that have a low likelihood of success. Theoretical explanations for the association between executive turnover and escalation include self-justification and reputation protection. Top managers may conceal prior errors, escalate commitment to earlier decisions, and exit the organization before the outcome of decisions is observed. Successor managers do not have a commitment to earlier decisions and have the capability to stop investments that are discovered to be failing. Empirical analysis utilizing a sample of over 1600 U.S. firms confirms that departures by non-CEO executives from top management teams are associated with an increased likelihood of new reporting of discontinued operations and extraordinary items by firms and a reduction in the firms' performances relative to their industry. These effects reflect de-escalation activities and are amplified in the years concurrent with and following a joint departure of multiple management team members. Prior empirical studies on escalation and de-escalation behavior focused on CEO turnover. The contribution of this article is its documenting of the key role of non-CEO managers and team turnover in the context of escalation.

Keywords: escalation of commitment; executive turnover; top management teams; analytics; corporate governance

1. Introduction

This study examines how turnover in a firm's top management team (TMT) relates to the re-evaluation of decisions at the firm and explores the evidence of escalation of commitment among TMT members. Escalation of commitment refers to a documented decision-making bias by managers who persist in allocating the firm's resources to a project despite receiving negative feedback about it (Staw and Ross 1987; Sleesman et al. 2012). Researchers are intrigued by escalation of commitment because it implies a systematic deviation from rational decision-making that leads to wasting resources on doomed projects. The primary theories explaining the escalation of commitment phenomenon rely on psychological factors such as the manager's self-justification in not admitting prior errors in choosing failing investments (Staw 1976, 1981), organizational factors such as the inertia that impedes the firm from altering its direction (Ross and Staw 1993; Brockner 1992), and economic factors such as the manager's strategic choice to hide previous mistakes in order to preserve his or her reputation (Kanodia et al. 1989; Chulkov and Barron 2021).

The existing literature suggests a positive correlation between escalation of commitment and turnover in a firm's management. This correlation follows from the personal responsibility effect, which states that the manager accountable for the initial project selection decision exhibits a higher propensity to reinvest in the same project (Staw 1976; Bazerman et al. 1984; Brody and Frank 2002). Managers may conceal prior mistakes in the allocation of the firm's resources, escalate commitment to earlier decisions, and then attempt to leave the firm before the outcome of their investment choices is observed. Incoming managers do not have a commitment to earlier decisions and are able to stop

investments that are discovered to be failing (Chulkov and Barron 2021). Consequently, turnover in management can serve as an effective strategy to halt over-investment and de-escalate excessive commitment to failing projects, particularly when the new decision makers bear no personal responsibility for the original decisions (Staw et al. 1997; Keil and Robey 1999; Kalmanovich-Cohen et al. 2018). Evidence of escalation of commitment can be observed in the de-escalation changes that follow management turnover (Staw et al. 1997; Chulkov and Barron 2019).

Escalation behavior reflects the principal–agent conflict as the behavior of the managers does not align with the interests of the firm (Sleesman et al. 2012). Corporate governance and internal auditing provide mechanisms for the alignment of the managers' incentives with those of the firm's principals (Shleifer and Vishny 1997; Tawfik et al. 2023). The escalation literature suggests that strong corporate governance and monitoring incentives help alleviate the escalation of commitment by managers (Buchholtz et al. 1999; Huang et al. 2016; Sleesman et al. 2018; Licht 2021). The rotation of duties in management has been proposed as a de-escalation strategy (Chulkov and Barron 2019). While these studies provide theoretical arguments, empirical evidence on the scale of escalation of commitment in businesses and the effectiveness of corporate governance mechanisms in addressing escalation of commitment remains limited (Sleesman et al. 2012; Chulkov and Barron 2021).

Much of the evidence on escalation-of-commitment behavior comes from psychological experiments (Staw 1976) and management case studies (Ross and Staw 1986, 1993; Sleesman et al. 2012). Empirical analysis of financial data linked to escalation and de-escalation of commitment in management remains relatively rare and focuses on the role of CEOs (Chulkov and Barron 2021). This study aims to fill the gap in the literature by examining the role of non-CEO executives in escalation of commitment.

Turnover by non-CEO managers is more common than that by CEOs (Fee and Hadlock 2004), and it has been linked to changes in the strategic direction of the firm (Hayes et al. 2006; Buyl et al. 2015; Cho et al. 2022) and firm performance (Hancock et al. 2013). The upper-echelons perspective views the strategic choices and performance of an organization as the result of decisions not only by the CEO but also by non-CEO members of the TMT (Hambrick and Mason 1984). Shen and Cannella (2002) argue that analysis of the entire TMT and not just the CEO is crucial for understanding changes at the firm.

In this study, an extensive data set of over 1600 publicly traded U.S. firms is created, covering the period from 1993 to 2019. Cases of turnover in top management teams are identified for the top four managers in each firm. The data set includes financial variables that are indicative of project terminations and strategic changes at the firm, including the initiation of new sequences of discontinued operations reporting, reporting of extraordinary items on financial statements, and changes in the return on assets relative to the firm's industry. The empirical analysis confirms that departures by non-CEO members of TMT are associated with an increased likelihood of new reporting of discontinued operations, more frequent reporting of extraordinary items, and a reduction in the firm's performance relative to its industry. Furthermore, these effects are stronger in the years concurrent with and following the joint departure of both the CEO and the non-CEO members of the top management team. Results also demonstrate that project terminations and strategic changes at firms do not precede such managerial turnover but are observed in the concurrent or subsequent year, which is consistent with de-escalation activities by incoming managers.

This article provides several contributions to research and practice. First, it presents empirical evidence consistent with the escalation of commitment by non-CEO members of TMTs. Earlier empirical research focused solely on CEO turnover in the context of escalation of commitment. This study contributes to the literature by documenting the key role of non-CEO managers in the escalation of commitment to failing investments. Second, it shows a pattern of project terminations related to non-CEO management turnover across several empirical measures, including discontinued operations, reports of extraordinary items, and reductions in the firms' return on assets. While discontinued operations have been

explored as a measure of strategic changes at the firm (Statman and Sepe 1989; Barron et al. 2011), the other measures provide new empirical evidence on the impact of TMT turnover. Third, the results suggest that changes in the firm's leadership may be an effective way to address escalation of commitment, as de-escalation changes are observed concurrently and subsequently to turnover by non-CEO members of the TMT. Fourth, these results inform corporate governance as well as decision-making by supervisory boards and shareholders in relation to top management escalation behavior.

The article proceeds in the following way. Section 2 presents the theoretical background and outlines the hypotheses. Section 3 describes data set construction and research methodology. Section 4 presents the results. The conclusion follows in Section 5.

2. Background and Hypotheses

Several empirical and experimental studies have suggested a link between executive turnover and escalation of commitment based on the personal responsibility effect. This effect implies that an executive who is responsible for the original selection decision tends to persist with the choice (Staw 1976; Bazerman et al. 1984). Their actions are subject to the escalation of commitment bias due to such reasons as self-justification (Sleesman et al. 2012) or attempts to protect reputation by avoiding recognition of mistakes (Kanodia et al. 1989). When such an executive leaves the decision-making position, the motivation to escalate the firm's commitment to the decision diminishes (Staw et al. 1997; Keil and Robey 1999; Kalmanovich-Cohen et al. 2018). The firm's new leadership, not personally responsible for the decisions made by the departed executives, can modify the firm's operations according to the firm's best interests. Consequently, departures by members of top management teams from the firm may adversely affect the firm's operations and performance as investment decisions are reversed and resources are redirected to alternative uses.

Barron et al. (2011), as well as Chulkov and Barron (2019), conducted empirical studies of CEO turnover and showed that CEO departures, particularly forced departures and contender successions, are related to negative outcomes at the firm, such as increased probability of discontinued operation reports and underperformance on financial metrics such as net income and market value. Chulkov and Barron (2021) constructed a principal-agent model of escalation behavior with asymmetric information. In this model, a top manager is responsible for selecting a firm's investment portfolio and later observes the outcome of these decisions before it is publicly revealed. If the choices made by the manager are discovered to be failing, the manager has an incentive to leave the firm before the failure is publicly known to limit reputation damage.

This earlier research examined the contribution of the CEO to escalation of commitment. The current article extends prior research by focusing specifically on the non-CEO members of the TMT. The emerging literature on the patterns of non-CEO top manager turnover shows that non-CEO turnover is common and has a significant impact on firms (Fee and Hadlock 2004; Messersmith et al. 2013; Buyl et al. 2015). The upper echelon perspective views the strategic choices and performance of an organization as the outcome of actions by not only the CEO but also non-CEO managers such as the COO, CFO, and CMO (Hambrick and Mason 1984). Shen and Cannella (2002) state that analyzing the whole top management team and not just the CEO is essential for understanding strategic changes at the firm. Carpenter et al. (2004) provide a comprehensive review of the upper echelon literature. The large data set created for this article contains information on non-CEO turnover for key members of the TMT. The upper echelons perspective implies that changes in the non-CEO members of the TMT influence strategic choices at the firm.

Reversals in the strategic decisions of the firm are reflected in the public reporting of discontinued operations that indicate the termination or sale of operations large enough to be classified as divisions (Statman and Sepe 1989). A broader measure of unusual changes in a firm's operations, not limited by accounting standards to divisions of the firm, is the accounting reporting of extraordinary items. When escalation of commitment is discovered and real investments made by the firm are discontinued, the firm is expected to

underperform compared to its industry peers, and a relative firm performance measure should capture this impact (Jenter and Kanaan 2015). Hypotheses 1, 2, and 3 describe the expected effect of turnover by non-CEO members of the TMT on the firm in the presence of escalation of commitment.

Hypothesis 1. *Turnover by non-CEO members of the TMT is positively associated with new discontinued operations by the firm.*

Hypothesis 2. *Turnover by non-CEO members of the TMT is positively associated with extraordinary items reported by the firm.*

Hypothesis 3. *Turnover by non-CEO members of the TMT is negatively associated with firm performance.*

Several studies show that the impact of turnover by non-CEO top managers is stronger when it coincides with the departure of the CEO from the firm (Fee and Hadlock 2004; Hayes et al. 2006; Buyl et al. 2015). Escalation of commitment in the TMT may occur as both an individual and a group process (Bazerman et al. 1984; Sleesman et al. 2012). The relationships specified in Hypotheses 1–3 are, therefore, expected to be enhanced when the non-CEO turnover occurs jointly with a departure by the CEO. This is represented by Hypotheses 4–6.

Hypothesis 4. *Joint turnover of the CEO and non-CEO members of the TMT is positively associated with new discontinued operations by the firm.*

Hypothesis 5. *Joint turnover of the CEO and non-CEO members of the TMT is positively associated with extraordinary items reported by the firm.*

Hypothesis 6. *Joint turnover of the CEO and non-CEO members of the TMT is negatively associated with firm performance.*

3. Data and Methodology

This study relies on an extensive data set constructed using data from the Compustat and the ExecuComp databases to examine the link between escalation behavior and turnover among non-CEO top executives. The approach to data set creation is similar to other studies that use a combination of the ExecuComp and Compustat data (Barron et al. 2011; Jenter and Kanaan 2015; Chulkov and Barron 2023). The data set includes variables that reflect the impact of reversals in the firms' investment choices that the theory suggests in situations of escalating commitment. Variables are also constructed to identify the CEO and non-CEO TMT members and instances of turnover involving these managers.

Construction of the data set originates with ExecuComp data for the period from 1992 to 2020. The data are combined with financial variables from Compustat on U.S. publicly traded firms. The initial sample comprises 3880 firms and 56,563 firm-year observations. Observations are excluded for firms that have an ambiguous CEO definition, such as co-CEOs and CEOs shared among firms, as well as for firms that undergo a major restructuring, such as spinoffs, mergers, or bankruptcy. Firms in the sample are required to have data for at least four members of the TMT, including the CEO. Firms that do not have such data are excluded. Firms are also excluded from the data set if there are missing data for key financial variables.

Managerial turnover is identified based on yearly changes in the list of top managers at the firm, following Chulkov and Barron (2024). A ranking of all executives listed at each firm by executive compensation was used to identify non-CEO members of the TMT. The ExecuComp data on top managers includes between four and eleven top managers for each firm in the data set. If a manager listed as either the CEO or one of the top three

non-CEO managers is not included again in the entire list of the firm's managers in the following fiscal year, then a turnover event is recorded in the data set. Variables are created to track turnover by non-CEO managers, by the CEO, as well as joint turnover by the CEO and at least one non-CEO member of the TMT. The measure of non-CEO turnover is equal to the total number of non-CEO members of the TMT leaving the firm in a fiscal year. Joint turnover of the CEO and non-CEO managers is recorded by a dummy variable that is equal to 1 when both the CEO and non-CEO managers leave the firm in a fiscal year and zero otherwise. Additional searches of full-text news were used to verify the timing of managerial turnover and confirm the cases of turnover identified during data set construction. The result is a data set of 3782 firms and 47,627 firm-year observations.

Three separate dependent variables are used in the empirical analysis to evaluate changes in the firm's operations around the time of non-CEO turnover. The first measure is the disclosure of new discontinued operations. Discontinued operations are parts of a firm's operations that have been sold or shut down and are reported separately from continuing operations on accounting statements (Statman and Sepe 1989). Since the financial implications of discontinued operations are commonly spread over multiple years, the analysis below focuses on the first disclosure of discontinued operations in each sequence. This is recorded as a dummy variable that equals 1 when such a sequence of discontinued operations was started in a fiscal year and zero otherwise. To focus the analysis, the final data set is restricted to firms that experience at least one report of discontinued operations in the sample period. This results in a sample of 1632 firms and 26,060 firm-year observations. As a robustness check, all the models reported in Section 4 are estimated for this restricted sample as well as the full sample. The significance of the results survives such alternative specifications.

Discontinued operations record division-level changes in the firm's strategic choices. Terminations of smaller projects are reflected in the reporting of extraordinary items in the accounting data. A dummy variable that indicates whether the firm reported extraordinary items in a fiscal year serves as the second measure of project terminations in the data set. Reversals in strategy and project terminations consistent with de-escalation of commitment by managers would also be reflected in measures of firm performance.

The third dependent variable is derived from the firm's rate of return on assets (ROA) based on CompuStat data. This is a measure of unexpected changes in the firm's rate of return derived by computing the difference between a firm's actual annual return on assets and the average rate of return for other firms in the same year and the same industry based on the two-digit NAICS code. This measure represents the relative rate of return on assets (Jenter and Kanaan 2015). Similar to the discontinued operations dependent variable, the measures of extraordinary items and relative ROA serve to reflect the economic impact of changes in the firm's strategy and performance. Table 1 presents summary statistics for the data sample. Table A1 in Appendix A outlines the definitions of variables and presents data sources.

Table 1. Summary statistics for data sample.

Variable	Mean	Standard Deviation	Min	Max	N
New discontinued operations	0.101	0.301	0	1	26,060
Extraordinary items	0.348	0.476	0	1	26,060
Relative return on assets (ROA)	0.007	0.172	−12.088	10.979	26,060
Non-CEO top management turnover	0.440	0.637	0	3	26,060
Joint departure of CEO and non-CEO managers	0.042	0.200	0	1	26,060
Log of assets	8.122	1.722	1.662	14.838	26,060
R&D to assets ratio	0.021	0.047	0	1.003	26,060
Market-to-book value	1.174	1.383	0.0002	84.260	26,060
Log of CEO tenure at firm	1.634	0.912	0	4.127	26,060
Fiscal year	2005.8	7.37	1993	2019	26,060

Note: Full description of the data appears in Appendix A, Table A1.

The methodology of the empirical analysis applies regression models with fixed effects to evaluate the impact of non-CEO TMT turnover on the firms in the data set. Three empirical models are estimated separately, one for each of the dependent variables. The fixed-effects specification is important in that it controls for differences across firms that may happen due to such factors as industry, company life cycle, and business strategy. Firm characteristics and changes over time are controlled with the inclusion of control variables suggested in the literature (Jenter and Kanaan 2015; Chulkov and Barron 2019; Chulkov and Wang 2023), as well as year dummy variables in each model.

4. Results

4.1. Impact of Non-CEO Top Management Turnover

The results on the impact of non-CEO turnover are reported in Table 2. The table presents three empirical models, one for each of the dependent variables. The results indicate that observed turnover by non-CEO members of the TMT is associated with reports of new discontinued operations, more frequent reporting of extraordinary items, and a reduction in a firm's performance relative to its industry. All of these findings are significant at the 1-percent level. The results of column (1) support Hypothesis 1, while column (2) provides support for Hypothesis 2, and column (3) confirms Hypothesis 3.

Table 2. Impact of non-CEO top management turnover on discontinued operations, extraordinary items reporting, and firm performance.

	New Discontinued Operations	Extraordinary Items	Relative ROA
	(1)	(2)	(3)
Non-CEO turnover	0.178 ** (0.0321)	0.0182 ** (0.0044)	−0.0099 ** (0.0016)
Log of assets	0.479 ** (0.0527)	0.0209 ** (0.0058)	−0.0211 ** (0.00208)
Prior year's R&D to assets ratio	3.232 ** (0.997)	0.0469 (0.124)	0.0969 * (0.0449)
Prior year's market-to-book ratio	−0.237 ** (0.0386)	−0.0200 ** (0.0027)	0.0103 ** (0.00097)
Log of CEO tenure	−0.0664 * (0.0281)	−0.0324 ** (0.0035)	0.00247 (0.0013)
Year Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	26,060	26,060	26,060

Statistical significance is denoted by * and ** at the 5% and 1% levels, respectively; standard errors are reported in parentheses.

4.2. Impact of Joint CEO and Non-CEO Top Management Turnover

Table 3 continues the analysis by including a measure of joint turnover by the CEO and non-CEO members of the TMT. As mentioned earlier, the regression models include firm-level fixed effects and year control variables. The results indicate that the patterns found in Table 2 are significantly enhanced when both the CEO and non-CEO members of the TMT leave the firm. The impact of joint turnover on the reporting of discontinued operations, extraordinary items, and relative firm performance is significant at the 1-percent level. The results reported in column (1) of Table 3 provide support for Hypothesis 4, while column (2) confirms Hypothesis 5, and column (3) supports Hypothesis 6.

Table 3. Impact of joint CEO and non-CEO top management turnover on discontinued operations, extraordinary items reporting, and firm performance.

	New Discontinued Operations	Extraordinary Items	Relative ROA
	(1)	(2)	(3)
Non-CEO turnover	0.136 ** (0.0336)	0.0125 ** (0.0045)	−0.0076 ** (0.0016)
Joint CEO and non-CEO turnover	0.478 ** (0.0949)	0.0694 ** (0.0142)	−0.0277 ** (0.00513)
Log of assets	0.476 ** (0.0527)	0.0205 ** (0.0058)	−0.0210 ** (0.00208)
Prior year's R&D to assets ratio	3.225 ** (1.000)	0.0405 (0.124)	0.0995 * (0.0449)
Prior year's market-to-book ratio	−0.231 ** (0.0385)	−0.0197 ** (0.0027)	0.0102 ** (0.00097)
Log of CEO tenure	−0.0994 ** (0.0289)	−0.0358 ** (0.0036)	0.00383 ** (0.0013)
Year Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	26,060	26,060	26,060

Statistical significance is denoted by * and ** at the 5% and 1% levels, respectively; standard errors are reported in parentheses.

Escalation of commitment may be a group phenomenon if the decision-making is distributed among the TMT (Bazerman et al. 1984; Kalmanovich-Cohen et al. 2018). Joint departures by both the CEO and non-CEO members of the TMT are more likely to result in the removal of personal responsibility and the correction of escalation decision errors. The results of Table 3 confirm the stronger impact of joint turnover in bringing about changes at the firm.

4.3. Timing of Top Management Turnover

The analysis in Table 4 explores the impact of the managerial turnover timing on the changes observed at the firm. As in all the previous analyses, the regression models include firm-level fixed effects as well as year control variables. The specifications in this table build upon the ones in Table 3 and introduce three dummy variables to identify the fiscal years before the joint turnover of both CEO and non-CEO members of the TMT, the fiscal years coincident with the joint turnover, and the fiscal years after the joint turnover.

The results confirm that the impact of TMT turnover on the firm's operations and performance is significantly stronger in the years concurrent with and subsequent to joint TMT turnover. This timing is consistent with the theories on escalation of commitment and the personal responsibility effect. As the executives responsible for the allocation of the firm's resources leave the firm, personal responsibility stops playing a role in the escalation of commitment process. De-escalation activities may be taken to address escalation that was not in the best interest of the firm (Staw et al. 1997; Keil and Robey 1999; Kalmanovich-Cohen et al. 2018).

Overall, the empirical results demonstrate the importance of turnover by non-CEO members of the TMT to the firm and its stakeholders. The impact of non-CEO turnover is enhanced when the CEO leaves the firm jointly with non-CEO managers. Turnover by members of the TMT serves an important role in corporate governance as it helps reveal and address escalation of commitment by top managers.

Table 4. Timing of top management turnover and discontinued operations, extraordinary items reporting, and firm performance.

	New Discontinued Operations	Extraordinary Items	Relative ROA
	(1)	(2)	(3)
Non-CEO turnover	0.133 ** (0.0337)	0.0120 ** (0.0045)	−0.00741 ** (0.0016)
Year before joint CEO and non-CEO turnover	0.204 (0.106)	0.0210 (0.0139)	−0.00941 (0.0050)
Year of joint CEO and non-CEO turnover	0.524 ** (0.0969)	0.0748 ** (0.0144)	−0.0296 ** (0.0052)
Year after joint CEO and non-CEO turnover	0.224 * (0.108)	0.0640 ** (0.0150)	−0.0149 ** (0.0054)
Log of assets	0.468 ** (0.0528)	0.0192 ** (0.0058)	−0.0206 ** (0.0021)
Prior year's R&D to assets ratio	3.195 ** (1.003)	0.0334 (0.124)	0.102 * (0.0449)
Prior year's market-to-book value ratio	−0.229 ** (0.0384)	−0.0195 ** (0.0027)	0.0102 ** (0.0010)
Log of CEO tenure	−0.0829 ** (0.0316)	−0.0303 ** (0.0039)	0.00271 (0.0014)
Year Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	26,060	26,060	26,060

Statistical significance is denoted by * and ** at the 5% and 1% levels, respectively; standard errors are reported in parentheses.

5. Discussion and Conclusions

This study examines the link between turnover by non-CEO members of top management teams and changes at the firm suggested by the escalation of commitment theory. Escalation of commitment happens when decision makers continue business investments that are unlikely to succeed. Theoretical reasons for the link between turnover and escalation include psychological factors such as self-justification and economic factors such as protection of reputation by managers (Sleesman et al. 2012; Chulkov and Barron 2019). TMT members may conceal prior decision errors, escalate commitment to earlier decisions, and depart from the firm before the outcome of their decisions is observed publicly. Incoming managers do not have a commitment to earlier decisions and are able to stop investments that are discovered to be failing (Chulkov and Barron 2021).

Empirical analysis based on a sample of over 1600 publicly traded U.S. firms confirms that departures by non-CEO members of top management teams are associated with an increased likelihood of new reporting of discontinued operations and extraordinary items, as well as a reduction in the firm's performance relative to their industry. Such reporting of new discontinued operations and extraordinary items is indicative of reversals in investment decisions in de-escalation of commitment. These effects are stronger when both the CEO and non-CEO top managers leave the firm. While earlier empirical research focused solely on CEO turnover in examining escalation of commitment, an important contribution of this study is its documenting of the key role of non-CEO members of the TMT.

This study complements research by Jiang et al. (2017), who suggest that executives in declining firms may exhibit ship-jumping behavior and voluntarily switch to new employers before their failure is detected to evade the stigma. The data set employed by Jiang et al. (2017) represents a much smaller sample of departures of Chinese executives who are usually not members of the TMT and are much earlier in their careers. In contrast, the data set in the current study incorporates over 1600 firms and a wide range of senior executives in top management teams.

Limitations of this study come from the nature of its data set. While the breadth of the data is extensive, covering more than 1600 U.S. firms over a quarter of a century, the granularity of the data does not allow for the examination of specific differences in corporate governance structure. The empirical analysis controls for multiple firm, industry, and executive characteristics; however, examination of the impact of variation in corporate governance, perhaps in a smaller and more granular data set, remains an area for future research. Sleesman et al. (2018) point out that escalation of commitment is a complex process driven by multiple organizational and economic factors, and a more detailed analysis of its context is important.

The results of this study indicate that changes in the firm's top management team may serve as an effective way to address escalation of commitment, particularly in the decisions that involve non-CEO members of the TMT. This contributes to both the growing research on de-escalation of commitment and the practice of corporate governance.

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Data Availability Statement: The data for this research were sourced from publicly available databases of *CompuStat* and *ExecuComp*. The data definitions and sources are listed in Appendix A.

Conflicts of Interest: The author declares no conflicts of interest.

Appendix A

Table A1. Variable definitions.

Variable	Definitions	Data Source
Return on assets (ROA)	The firm's net income before extraordinary items and discontinued operations divided by total assets.	Compustat
New report of discontinued operations	Dummy variable is equal to 1 if the firm started a new sequence of discontinued operations reporting in the fiscal year and zero otherwise.	Compustat
Extraordinary Items	Dummy variable is equal to 1 if the firm reported after-tax items as extraordinary or exceptional after net income from continuing operations.	Compustat
Log of assets	Natural logarithm of book value of total assets.	Compustat
Market-to-book value	Market value of the firm divided by the book value of assets.	Compustat
R&D to book value	R&D spending of the firm divided by the book value of assets.	Compustat
Log of CEO tenure at firm	Natural logarithm of the number of years in which CEOs stay in position.	ExecuComp
Non-CEO top management turnover	Total number of top management team members departing the firm in a fiscal year.	ExecuComp, Author calculations
Joint CEO and non-CEO turnover	Dummy variable is equal to 1 if the CEO leaves the firm and at least one other TMT member also leaves the firm in a fiscal year and zero otherwise.	ExecuComp, Author calculations

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Article

Do CEOs Identified as Value Investors Outperform Those Who Are Not?

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Abstract: The aim of this study is to examine whether good asset allocation by a CEO leads to superior stock returns and, if so, how one might be able to identify CEOs that are good asset allocators. Employing US data from May 2001 to April 2019, we find that CEOs that invest the company's cash flows according to a value-investing style seem to outperform companies that do not. We find that high goodwill to assets and high operating margin (good asset allocator) companies outperform companies with high or low goodwill to assets and low operating margin (poor asset allocator) companies. The findings are corroborated with out-of-sample (May 2019–April 2023) robustness tests. When buying other businesses, value investor CEOs ensure that their consolidated operating margins remain high, as opposed to other firms managed by poor asset allocator CEOs who buy businesses that bring down operating margins, either because they overpay or due to an inability to materialize expected synergies. Using both summary statistics and regression analysis, the findings of this study help us identify companies that allocate assets like value investors and enable us to anticipate future stock performance. For example, if a company, on average, has a goodwill/assets ratio of 41.03%, and an operating margin of 21.38%, it is likely this firm would be at the top quartile in terms of stock return performance over at least the next three years. At the same time, if a firm has a low average goodwill/assets ratio (i.e., 1.95%), its operating margins, on average, should be 24.46%, if it wants to achieve a similar performance as that of firms with high goodwill/assets. Moreover, the future stock return predictability of high (low) goodwill/assets and high (low) operating margin firms, found in this study, can help an investor develop trading strategies that can lead to superior stock price performance by effectively taking long positions in (shorting) firms that are (not) managed by value investor CEOs. Finally, the paper's findings can also help investors in another way. For example, investors tend to be skeptical about companies with high goodwill/assets. The rule of thumb is to beware of companies carrying goodwill on their balance sheets that is more than 25% of assets. Based on our findings, this should not be a problem as long as the company's operating margin has remained high and is rising.

Keywords: asset allocation; value investor; goodwill/assets; operating margin; CEO role

1. Introduction

CEOs perform two roles: one is that of an operator and the other is that of a capital allocator. Most CEOs focus on managing operations and tend to be good at that. They acquired the skill of managing operations through years of working in various functions within their organization, and they have risen through the ranks of their organization because they excelled in this role. Capital allocation, however, is a skill that most CEOs do not learn on their way up and so they become CEOs without mastering capital allocation (see Berkshire Hathaway annual reports (Berkshire Hathaway 1987–1989), Griffin (2015, p. 140)). This, according to Mr. Buffett, “can create big problems for a business because the CEO will often not know how to make critical decisions that will maximize shareholder value” and “... it would be a terrible mistake if capital allocation were not the main talent of his successor” (see Stempel (2017)). In his book entitled “outsiders”, Thorndike (2012, p. xvi), refers to capital allocation as “a CEO's most important job”. Moreover, as Wurgler (2000) has shown, rapid asset growth is

associated with poor future stock returns, which is evidence that the average CEO is not a good asset allocator.

What exactly does it mean to be a good capital allocator? It means for the CEO to have the skills necessary to take the cash that the company generates and deploy it to the best value-maximizing opportunity for the company, be it buying another company, buying back shares, paying higher dividends, reinvesting within the company, etc. These are all investment decisions. In other words, the best CEOs are those who are good value creators, as well as good value seekers. To be a good value seeker, the CEO must be a good investor, and, more importantly, be a value investor. They must also share personality traits that value investors have, such as independent thinking, patience, discipline, and contrarianism. There is limited research on CEO personality and stock price performance. Liu (2019) finds that CEO conscientiousness (i.e., self-disciplined, systematic, organized) tends to be negatively associated with stock price crash risk. Kim et al. (2016) find that CEO overconfidence is positively related to stock price crash risk. Value investor CEOs are independent thinkers, contrarian, disciplined, and humble, traits that should lead to better long-term stock performance according to these studies.

To the best of our knowledge, there has been no finance academic study trying to examine the long-term performance of value investor CEOs (i.e., capital allocators) and compare it to the performance of those CEOs who are not good capital allocators. As a result, the aim of this study is to examine whether good asset allocation by a CEO leads to superior stock returns and, if so, how one might be able to identify CEOs that are good asset allocators.

The challenge is to be able to devise a metric to identify good capital allocators and separate them from those who are not. One can think of several ways of doing so. Thorndike (2012) suggested that one looks at the multiples, such as P/E or P/B, at which a company buys back its own shares or the multiples at which a company acquires the shares of another company in a merger transaction. In a similar vein, another approach would be to look at the P/E or P/B at which a CEO (an insider) buys shares on his own account in an insider trade. A combination of all the above would be even better. This is because we know that value investors prefer to invest in stocks that have low P/E or P/B (see Athanassakos (2011)). Moreover, value investing tends to outperform other styles of investing in the long run (see Athanassakos (2011); Chan and Lakonishok (2004); Chan et al. (1991); Davis et al. (2000); Fama and French (1992, 1993)). Chowdhury et al. (2016) find that CEOs earn abnormal returns from opportunistic trading that is motivated by their contrarian beliefs. Piotroski and Roulstone (2005) also find that insiders are contrarian, while Gregory et al. (2013) associate insiders' contrarian style (buying value stocks and selling glamour stocks) with earning abnormal returns. Nevertheless, there is plenty of evidence to indicate that stock buybacks peak (bottom) at the highest (lowest) point of the bull (bear) market and business cycle. Lountzis (2019, p. 11), in one of his newsletters, states "*... during the most attractive period in 2008–2009, when prices were at the lowest, companies spent the least amount on buybacks, yet as stock prices continued to rise, buybacks rose, raising the question as to whether most buybacks were a prudent allocation of capital*".

In this paper, we will examine the ratio of goodwill to assets in conjunction with operating margins as a composite metric to separate good asset allocators from those who are not. Mergers and acquisitions (M&A) represent by far the largest use of capital over time by a CEO; that is why, in this paper, we focus on capital allocation CEO skills in relation to M&As (see Mauboussin and Callahan (2014)).

Merger-related goodwill was amortized up until 2000. Starting in 2001, merger goodwill was no longer amortized. Instead, goodwill is now tested for impairment and, if found to be impaired, it is written down. What this means is that the goodwill we observe on the company balance sheet, since 2001, is of much better quality and information. High goodwill/assets implies that goodwill had been tested and found to have value. Low goodwill/assets, on the other hand, implies one of two things: either that companies had not been involved in mergers (i.e., only organic growth) or that they had overpaid for a

target and consequently goodwill was written off. That is why in our study we covered the period starting in 2001 and we used U.S. data, which enabled us to have a larger sample. We examined individual company goodwill/assets to further justify our thesis that high goodwill/assets reflects a value CEO. If goodwill to assets is comparatively high, these companies will remain in our value CEO sample. They will be removed from the value CEO sample if goodwill to assets is comparatively low. At the same time, CEOs who did not overpay for an acquisition are frugal, as value investors are, and mindful of controlling costs and avoiding keeping excess labor or assets on the balance sheet. This will ensure that operating margins will remain high. We recognize that others may also have an input in a merger transaction, such as board members, CFOs, and even shareholders. However, it is the CEO who is the main driver of the deal and responsible for making the merger work.

A good example is General Electric. As Katsenelson (2018) states in one of his newsletters “if you examine why GE has been a poor investment over the last two decades, you’ll find that it’s because of poor asset allocation. They lost a lot of value in destroying acquisitions—they bought business at high prices, relied on false or unfulfilled synergies, and sold (divested) at reasonable (or low) prices”.

That is why we examined companies with high goodwill/assets in conjunction with high operating margins, with the combination of both reflecting a value CEO. Companies with high goodwill to assets and high operating margins must be those that are managed by good asset allocators, whereas companies with high (or low) goodwill to assets and low operating margins must be those that are not managed by good asset allocators. It is possible that companies with high goodwill/assets and a high operating margin may have other valuable investment opportunities that are driving the results. We will try to address this issue with industry and time fixed effects in the regression analysis carried out in the empirical part of the paper. Regression analysis will also allow us to examine whether we can anticipate a company’s future stock performance by identifying companies whose CEOs allocate assets like value investors.

We find that companies managed by good capital allocator (i.e., value investor) CEOs outperform companies that are not managed by value investor CEOs. For example, between May 2001 and April 2019, on average, the portfolio of good asset allocator companies outperforms the portfolio of bad asset allocator companies by 36 per cent in terms of cumulative three-year returns. When buying other businesses, value investor CEOs ensure that their consolidated operating margins remain high, as opposed to other firms managed by poor asset allocator CEOs who buy businesses that bring down operating margins, either because they overpay or due to an inability to realize expected synergies. Buying businesses cheaply allows value investor CEOs to create value for their shareholders. This is a very interesting result considering evidence that value-investing portfolios have performed poorly between 2012 and 2019 as opposed to earlier years (see Fama and French (2020)).

We also find that if a company had goodwill-to-assets of between 30 and 52 per cent (+/– one standard deviation from the mean), and operating margin of between 15 and 28 per cent (+/– one standard deviation from the mean), then the firm would most likely be at the top quartile in terms of stock return performance over at least the next three years. These are the companies an investor should buy and hold for the long run, as these are indeed stocks Warren Buffett would like. The regression analysis carried out in the paper added to the evidence that we can anticipate a company’s future stock performance by identifying companies whose CEOs allocate assets like value investors.

Finally, the paper’s main findings are corroborated by out-of-sample tests (May 2019–April 2023) and results obtained by Cunningham (2020a, 2020b), who examined a similar question but from a different angle.

The rest of the paper is structured as follows. Section 2 reviews the literature and forms expectations; Section 3 discusses the data and the methodology; Sections 4 and 5 report the summary statistics and regression results, respectively; Section 6 examines out-of-sample evidence; while the last section concludes the paper and discusses the findings.

2. Literature Review and Formation of Expectations

To the best of our knowledge, there are no academic studies examining the performance of good asset allocator CEOs and comparing it to the performance of CEOs who are not good asset allocators. Moreover, there have not been any previous studies that examined how asset allocation by CEOs, proxied by the combination of goodwill/assets and operating margins, can predict stock performance.

There is little reference in finance academic papers regarding the benefits of good asset allocation. Wurgler (2000), for example, has shown rapid asset growth is associated with poor future stock returns, which is *indirect* evidence that the average CEO is not a good asset allocator. Bandiera et al. (2020) examine what CEOs do and how differences in CEO behavior relate to differences in company performance. While they show that CEOs differ in their behavior along several dimensions, capital allocation was not one of them. Fahlenbrach (2009) examines founder and non-founder CEO firms and finds that founder CEO firms have higher stock market performance. Could it be because of better capital allocation? He does not come right out and say this, but what he finds is that founder-led CEO firms tend to undertake more acquisitions and invest more in R&D and capital expenditures, i.e., *indirect* evidence of better capital allocation.

Nevertheless, most of the discussion regarding asset (or capital) allocation has come primarily from practicing investors. Thorndike (2012, p. xvi), for example, refers to capital allocation as “*a CEO’s most important job*”. Katsenelson (2018) attributes the dismal performance of GE stock between 2000 and 2021 to poor asset allocation. Additionally, stock buy-backs, which are supposed to be done at low PE ratios by companies, in fact, happen when PEs are at their highest level for the business cycle, again indicating that the average CEO is not a good asset allocator (see Lountzis (2019, p. 11), Mauboussin and Callahan (2024)).

On the other hand, several studies have examined the effect of the magnitude of a firm’s goodwill on a company’s stock performance. For example, Liu et al. (2019) found that high goodwill/sales have a negative effect of future stock performance, while Satt and Youssef (2017) found that high levels of goodwill lead to positive stock returns for large firms. Does firm size affect the effect of goodwill/assets on future stock performance and a CEO’s ability to be a good asset allocator? What if high goodwill/assets has to be combined with high operating margin to produce unambiguous results?

There is also little research on CEO personality and stock price performance. Liu (2019) finds that CEO conscientiousness (i.e., self-disciplined, systematic, organized) tends to be negatively associated with stock price crash risk. Kim et al. (2016) find that CEO overconfidence is positively related to stock price crash risk. Value investor CEOs (i.e., good asset allocators) are independent thinkers, contrarian, disciplined, and humble, traits that should lead to better long-term stock performance according to these studies (see Montier (2009)).

Given that investing is itself an act of asset allocation, parallels between value investing and CEOs’ asset allocation decisions are drawn to test the hypothesis that CEOs that allocate their companies’ assets in a value-investing style tend to outperform in the stock market those that do not. If a CEO is acting like a value investor, he/she will be buying companies cheaply in an M&A transaction, sustain high operating margins, and thus be able to create value for their shareholders. Such firms should outperform, on a stock return basis, those firms that have poor asset allocation exemplified by a high (or low) goodwill to assets ratio but low operating margins. The assumption here is that companies that are heavily involved in mergers and acquisitions will have high goodwill relative to their assets, as they are undertaking multiple acquisitions. However, these acquisitions would not come at the expense of the operating margins of the combined firms.

As such, we expect good asset allocator companies (companies with a high ratio of goodwill to assets and high operating margins) to outperform those companies that do not have good asset allocation (companies with a high (or low) ratio of goodwill to assets, but low operating margins).

3. Data and Methodology

The key question the paper is trying to answer is: does good asset allocation by a CEO lead to superior stock returns and, if so, how might one be able to identify CEOs that are good asset allocators? To answer the question, we calculate one-, two- and three-year cumulative total stock returns for good and bad asset allocator companies, as well as relate summary statistics of company stock market performance to the key metrics examined in the paper, which combine goodwill/assets and operating margins. We also carry out regression analysis, which allows us to examine whether we can anticipate a company's future stock performance by identifying companies whose CEOs allocate assets like value investors.

As indicated earlier, good asset allocator CEOs will be buying companies cheaply in an M&A transaction, sustain high operating margins, and thus be able to create value for their shareholders. Bad asset allocator CEOs are exemplified by companies that have a high (or low) goodwill to assets ratio, but low operating margins.

We employed US stock market data from the COMPUSTAT database for the period May 2001 to April 2019. Balance sheet and income statement data are for the period December 2000–December 2015. We excluded the years of the pandemic as the pandemic was a once-in-100-year event that impacted company performance in unexpected ways, and many times in ways unrelated to fundamentals and CEO abilities. The COVID-19-related economic crisis may also alter company asset allocation plans, making targets unachievable, thus losing their power and negatively affecting performance.

We included all NYSE, AMEX, and NASDAQ stocks that had a fiscal year end of December and reported their year-end financials by the end of the following April. We excluded closed-end funds, REITs, financials, and companies that reported no goodwill or companies that did not have a complete data set in terms of desired data, such as revenues, operating income, assets, and goodwill. We also excluded companies for which there was not enough data to calculate 1-, 2-, and 3-year cumulative total stock returns and penny stocks, that is, stocks priced at USD 1 or less.

We started with 21,666 firm–year observations belonging to 4031 unique companies. After all screens, we ended up with 17,331 firm–year observations belonging to 3266 unique companies. The 4-digit SIC classification code (obtained from Wharton Research Data Services, WRDS) of industries to which companies in this study belong and the number of observations per industry are shown in Table 1.

Table 1. The table reports the 4-digit SIC classification code (obtained from Wharton Research Data Services, WRDS) of industries to which companies in this study belong and the number of observations per industry.

Industry Classification	Number of Observations
Agriculture, Forestry and Fishing	80
Construction	308
Manufacturing	8720
Mining	343
Other	20
Retail Trade	1322
Services	4225
Transportation, Communications, Electric Gas and Sanitary Services	1499
Wholesale Trade	814
Total	17,331

We calculated operating margin as operating profit/revenues and divided goodwill over assets for each stock to obtain the desired metrics for separating good asset allocators from those who are not. We also calculated one-, two-, and three-year cumulative total stock returns for good and bad asset allocator companies.

All companies in our sample had a December fiscal year end. We excluded firms with non-December year ends to ensure appropriate inter-temporal comparisons over our cross-section (see Givoly (1985)). At the end of April of each year (t) between 2001 and 2016, companies were sorted by goodwill/assets into quartiles based on previous ($t - 1$) fiscal year-end data. All companies in our sample had fiscal year ($t - 1$) results reported by April of year (t). Membership in a quartile changes from year to year. Quartile one (Q1) includes stocks in the bottom 25% of goodwill/assets, whereas quartile four (Q4) includes stocks in the top 25% of goodwill/assets. Next, for every year, the top and bottom goodwill/assets quartiles were subdivided into quartiles based on operating margins (also sorted as at the end of April of year (t)). The first quartile (Q1) includes the stocks in the bottom 25% of operating margins, whereas the fourth quartile (Q4) includes stocks in the top 25% of operating margins. In other words, we double sort our sample per year by goodwill/assets and operating margins. One-, two-, and three-year cumulative annual total returns were then calculated from May of year (t) to April of year ($t + 1$), ($t + 2$) and ($t + 3$), respectively.

For each year, the returns of companies in the fourth quartile of goodwill to assets (Q4GWA) and fourth quartile of operating margins (Q4OM) were compared with the returns of companies in the fourth quartile of goodwill to assets (Q4GWA) and first quartile of operating margins (Q1OM). Similarly, the returns of companies in the first quartile of goodwill to assets (Q1GWA) and first quartile of operating margins (Q1OM) were compared with the returns of companies in the first quartile of goodwill to assets (Q1GWA) and fourth quartile of operating margins (Q4OM).

To examine whether OM is more important than GWA in driving the relationship between stock returns, whether the results are driven by other characteristics that are different between groups, and whether companies with high GWA and high OM have other valuable investment opportunities (which are industry specific), and to guard against endogeneity bias in our tests, we use lagged values of the independent variables, and so we regressed one-year stock returns at time (t) against several variables of interest (at time ($t - 1$)), as independent variables, and control for time and industry fixed effects. This is a pooled cross-sectional, time series OLS regression. In other words, the regression is:

$$R_{j(t)} = a + b \times GWA_{(t-1)} + c \times OM_{(t-1)} + d \times GWA_{(t-1)} \times OM_{(t-1)} + e_{j(t)} \quad (1)$$

where $R_{j(t)}$ represents annual returns, $GWA_{(t-1)}$ is goodwill/assets lagged by one year, $OM_{(t-1)}$ is operating margin lagged by one year, and $GWA_{(t-1)} \times OM_{(t-1)}$ is an interaction variable of the two key independent variables, which enables us to examine whether the relationship between $R_{j(t)}$ and $GWA_{(t-1)}$ changes depending on the value of $OM_{(t-1)}$.

4. Summary Statistics

Table 2, Panel A, reports summary statistics for GWA, and OM for Q4GWA & Q4OM, Q4GWA & Q1OM, Q1GWA & Q4OM, and Q1GWA & Q1OM for May 2001 to April 2019. More interesting results, however, appear in Table 2, Panel B, which reports the one-, two-, and three-year cumulative returns for various combinations of GWA and OM. The three-year cumulative stock returns remained at high levels for Q4GWA & Q4OM and Q1GWA & Q4OM, and low levels for Q4GWA & Q1OM and Q1GWA & Q1OM.

Table 2. Summary statistics of various combinations of goodwill/assets (GWA) and operating margin (OM). The table also reports one-year, two-year, and three-year cumulative returns for various combinations of GWA and OM. Annual return data are for the period May 2001–April 2019. Balance sheet and income statement data are for the period December 2000–December 2015.

Panel A: Summary Statistics for Various Combinations of Goodwill/Assets (GWA) and Operating Margin (OM).									
	GW/Assets			Operating Margin					
	Mean	Median	STD	Mean	Median	STD			
Q4GWA & Q4OM	0.4103	0.3845	0.1101	0.2138	0.1923	0.065			
Q4GWA & Q1OM	0.4193	0.3887	0.1296	−0.0744	−0.0664	0.170			
Q1GWA & Q4OM	0.0195	0.0165	0.0151	0.2446	0.2166	0.095			
Q1GWA & Q1OM	0.0213	0.0197	0.0145	−0.0516	−0.0404	0.185			
Panel B: Summary Statistics for One Year, Two Year and Three-Year Cumulative Returns for Various Combinations of GWA and OM									
	One-Year Return			Two-Year Cumulative Return			Three-Year Cumulative Return		
	Mean	Median	STD	Mean	Median	STD	Mean	Median	STD
Q4GWA & Q4OM	0.0978	0.0781	0.336	0.2089	0.1662	0.452	0.3669	0.2736	0.613
Q4GWA & Q1OM	0.0229	−0.1135	0.582	−0.0410	−0.1940	0.602	0.0322	−0.1774	0.788
Q1GWA & Q4OM	0.0958	0.0734	0.355	0.2119	0.1468	0.503	0.3634	0.2475	0.638
Q1GWA & Q1OM	0.0809	−0.0459	0.591	0.01022	−0.1287	0.584	0.0285	−0.1588	0.705

Note: Fourth quartile of goodwill to assets (Q4GWA), fourth quartile operating margins (Q4OM), fourth quartile of goodwill to assets (Q4GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), fourth quartile of operating margins (Q4OM).

We also observe in Table 2, Panel B that while the high GWA and high OM stocks (Q4GWA & Q4OM) had the highest three-year cumulative returns among all combinations of GWA and OM, namely, mean/median 0.3669/0.2736, the low GWA and high OM stocks (Q1GWA & Q4OM) had three-year cumulative returns that were not far behind, namely, mean/median 0.3634/0.2475. That is, both the high GWA and low GWA stocks, on average, performed equally well, even though, as we had discussed earlier, we expected the first group of stocks to have better asset allocation. It is possible that the low GWA companies, having been involved in few acquisitions, operated quite efficiently and thus sustained high OM as they saved M&A related costs, such as costs of integration and costs of conflicts arising from culture differences.

On the other hand, stocks with low GWA and low OM (Q1GWA & Q1OM) and stocks with high GWA and low OM (Q4GWA & Q1OM) had inferior stock market performance to both previous groups of stocks, namely, mean/median 0.0285/−0.1588 and 0.0322/−0.1774, respectively. These could be companies with either poor asset allocation or both inferior asset allocation and poor operational management. These could also be companies with bad business or bad business models.

Could the higher stock returns of the Q4GWA & Q4OM (in Table 2, Panel B) be due to the small firm effect? Table 3 answers this question. It shows that the combination of Q4GWA & Q4OM has the largest revenues and assets compared to all other quartile combinations and, as a result, provides enough evidence to indicate that this finding cannot be driven by the well-known small firm effect (see Keim (1983)).

Table 3. The table reports mean firm asset and revenue values in USD (millions) of various combinations of portfolio quartiles based on GWA and OM sortings.

US\$ (Millions)	Assets	Revenues
Q4GWA & Q4OM	7953.5	4353.1
Q4GWA & Q1OM	450.1	368.5
Q1GWA & Q4OM	7228.4	4166.57
Q1GWA & Q1OM	1633.5	1658.6

Note: Fourth quartile of goodwill to assets (Q4GWA), fourth quartile operating margins (Q4OM), fourth quartile of goodwill to assets (Q4GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), fourth quartile of operating margins (Q4OM).

5. Regression Results

As we saw earlier in Table 2, Panel B, companies with high operating margins, irrespective of the size of goodwill/assets, produced higher one-, two-, and three-year cumulative stock returns than companies with low operating margins across all periods. Moreover, as shown in Table 4, the three-year cumulative stock returns between Q4GWA & Q4OM vs. Q1GWA & Q4OM (t-stat = 0.26) and Q4GWA & Q1OM vs. Q1GWA & Q1OM (t-stat = 0.24) are not statistically different from each other. The biggest (absolute) statistically significant return differences are for Q4GWA & Q4OM vs. Q4GWA & Q1OM (t-stat = 8.06), Q4GWA & Q4OM vs. Q1GWA & Q1OM (t-stat = 7.67), Q4GWA & Q1OM vs. Q1GWA & Q4OM (t-stat = −10.65), and Q1GWA & Q4OM vs. Q1GWA & Q1OM (t-stat = 11.69), that is, for companies that attain high or low GWA in combination with high OM.

Table 4. T-statistic testing the significance of the mean three-year cumulative return differences between various goodwill/assets (GWA) and operating margin (OM) combinations. Annual return data are for the period May 2001–April 2019. Balance sheet and income statement data are for the period December 2000–December 2015.

May 2001–April 2019	t-Statistic
Q4GWA & Q4OM vs. Q4GWA & Q1OM	(8.06) *
Q4GWA & Q4OM vs. Q1GWA & Q4OM	(0.16)
Q4GWA & Q4OM vs. Q1WA & Q1OM	(7.67) *
Q4GWA & Q1OM vs. Q1GWA & Q4OM	(−10.65) *
Q4GWA & Q1OM vs. Q1GWA & Q1OM	(0.24)
Q1GWA & Q4OM vs. Q1GWA & Q1OM	(11.69) *

Note: Fourth quartile of goodwill to assets (Q4GWA), fourth quartile operating margins (Q4OM), fourth quartile of goodwill to assets (Q4GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), fourth quartile of operating margins (Q4OM). * Signifies 1% level of significance.

These findings raise the question: could OM rather than GWA be driving the relationship between stock returns and various combinations of GWA and OM documented in Table 2, Panel B? Moreover, could the results be driven by other characteristics that are different between groups? Or is it possible that companies with high GWA and high OM have other valuable investment opportunities (which are industry specific)¹ that are driving the results? To address these questions, we ran regression (1), which regressed one-year stock returns against several variables of interest, as independent variables, and control for time and industry fixed effects. Possible endogeneity bias in our test is addressed by using lagged values of the independent variables (see Equation (1)). This is a pooled cross-sectional, time series OLS regression. Results are reported in Table 5. In this table, Newey–West heteroskedastic and autocorrelation robust t-statistics are reported in brackets under the coefficient estimates.

Table 5. Regression results (coefficients) from regressing one year stock returns $R_j(t)$ at time (t) for the period May 2001–April 2019 against goodwill/assets lagged by one year ($GWA_{(t-1)}$), operating margin lagged by one year ($OM_{(t-1)}$), and an interaction variable $GWA_{(t-1)} \times OM_{(t-1)}$ as shown in regression (1) below. Regressions control for time and industry fixed effects.

Dependent Variable	Intercept	Goodwill/Assets ($GWA_{(t-1)}$)	Operating Margin ($OM_{(t-1)}$)	GWA $\times$ OM ($GWA_{(t-1)} \times OM_{(t-1)}$)	R-Squared
Panel A					
One-year stock returns at time (t)	0.1060	−0.0235	−0.0024	0.0060	0.04
(t-stat)	(2.05) **	(−1.24)	(−4.27) *	(3.61) *	

Note: Newey–West heteroskedastic and autocorrelation robust t-statistics are shown in brackets under the coefficient estimates. *, ** Signify 1% and 5% levels of significance, respectively.

Table 5 reports regression results from regressing the one-year stock returns at time (t) against $GWA_{(t-1)}$, $OM_{(t-1)}$, and an interaction term of $GWA_{(t-1)} \times OM_{(t-1)}$. We observe that the interaction variable is positive and statistically significant (t-stat = 3.61), while the only other variable that is statistically significant is OM but with a negative coefficient (t-stat = −4.27). The higher the product between GWA and OM, the better the returns (i.e., as per the interaction coefficient of +0.006). This explains why Q4GWA & Q4OM gives the best results, while Q1GWA & Q1OM gives the worst results. However, it cannot explain why Q4GWA & Q1OM gives poor results, whereas Q1GWA & Q4OM gives very good results. This can be explained by the negative coefficient of OM in the equation. The implication of this is that while companies with high/low GWA and high OM achieve highly positive future stock returns, the benefit is coming more from high GWA than high OM. Notice that the total benefit from high GWA is 0.0060 (GWA non-significant), whereas the total benefit from high GWA and high OM is 0.0036 (i.e., 0.0060−0.0024). In other words, it is GWA that is the driving force behind the high returns of Q4GWA & Q4OM, not high OM.

It is true that the model R^2 is only 4% and this may be a cause for concern. However, just because R^2 is small does not mean that our model is bad, or its interpretation is worthless. In studies of stock return data predictability, such as this study, it is not possible to include all the relevant predictors to explain stock returns, which may lead to a lower than desired R^2 value.

The findings in this study can be used to develop trading strategies given the predictability of the combination of Q4GWA or Q1GWA and Q4OM. For example, zero investment portfolios can be formed by buying the Q4GWA and Q4OM stocks and shorting the Q1GWA and Q1OM stocks. The cumulative total stock returns for such a strategy would have amounted to over 30% over the three-year period. A more careful and thorough analysis of such trading strategies, however, is left for future research.

6. Out-of-Sample Robustness Tests

6.1. Quality Investors and Quality Companies

Could we find corroborating out-of-sample evidence by examining a related study using data that is different but highly correlated with the data employed in this paper?

Cunningham (2020a, 2020b) has written extensively about quality (Buffett-type) shareholders, “those who see themselves as part and permanent owners of business, who load up, stick around and engage like owners”. His findings dovetail well with the findings of this study. Cunningham ranks 2070 companies based on their relative density of shareholders having long average holding periods and high concentration levels. Out of this study’s 167 good asset allocator US companies drawn out of sample in December 2019 (see Appendix A), 140 of them were also in Cunningham’s database of quality sharehold-

ers. This out-of-sample evidence provides further validation of our methodology and in-sample findings. Moreover, as one would expect, based on Cunningham's data and our findings, good asset allocator CEOs seem to attract high-quality shareholders. Future research will examine in more depth questions such as, do companies led by good asset allocator CEOs attract high quality shareholders, and is it true that high quality shareholders gravitate to those companies? Moreover, future research can also examine whether good asset allocator CEOs tend to prefer to work for companies that have high concentration of high-quality shareholders?

6.2. Asset Allocators during the Pandemic Years (May 2019–April 2023)

The in-sample tests focused on years outside the pandemic, i.e., May 2019–April 2023. As indicated earlier, we excluded the years of the pandemic as the pandemic was a once-in-100-year event that impacted company performance in unexpected ways, and many times in ways unrelated to fundamentals and CEO abilities. The COVID-19-related economic crisis may also alter company asset allocation plans, making targets unachievable, thus losing their power and negatively affecting performance. However, could it be that challenging times, such as those of the pandemic years, provide the opportunity for excellent CEOs to shine, especially those who are good capital allocators and may be able to find many more undervalued investments to invest in? In this case we would expect to find stronger results in the out-of-sample period (May 2019–April 2023) compared with those from the in-sample period (May 2001–April 2019).

For these tests, we had 1872 firm-year observations with firms allocated in different industries in a similar fashion as was the case in the original sample. Moreover, as in the original sample, the combination of Q4GWA & Q4OM has the largest revenues and assets compared to all other GWA and OM quartile combinations.

Tables A1 and A2 in Appendix B replicate Tables 2 and 4, but with out of sample data. The results are qualitatively the same as in the original sample period. In Table A1, the combination Q4GWA & Q4OM had a mean/median three-year cumulative return of 0.382/0.388, while combination Q1GWA & Q4OM had a mean/median three-year cumulative return of 0.409/0.112. Unlike the original period where the former combination had the highest mean and median three-year cumulative return, in the pandemic-extended period, only the median of the former combination is the highest, while it is the later combination's mean that is the highest. Given, however, the small number of observations in the out-of-sample tests via a vis the in-sample number of observations (particularly for the three-year cumulative stock returns), the median findings may be more reliable. The other two combinations had negative mean and median three-year cumulative returns, reinforcing the findings of the original period.

Findings are consistent in Table A2. Given the smaller number of observations, this table reports both mean and median tests, putting more emphasis on the median tests. While Q4GWA & Q4OM and Q1GWA & Q4OM had about similar performance (t -stat = -0.24 , chi-squared = 2.21), Q4GWA & Q4OM statistically outperformed Q4GWA & Q1OM (t -stat = 3.99, chi-squared = 23.7), and only in terms of the median in Q1GWA & Q1OM (t -stat = 0.85, chi-squared = 6.57). On the other hand, Q1GWA & Q4OM statistically outperformed Q4GWA & Q1OM (t -stat = -3.90 , chi-squared = 18.78) and only in terms of the median in Q1GWA & Q1OM (t -stat = 0.93, chi-squared = 5.89). Finally, Q1GWA & Q1OM statistically outperformed Q4GWA & Q1OM (t -stat = -2.07 , chi-squared = 5.15).

In summary, excluding the pandemic years from the original sample did not materially change the conclusions of the paper. The pandemic was a non-event as far as good vs. bad capital allocators are concerned. As result, the hypothesis that we would expect to find stronger results in the May 2019–April 2023 period is not supported by the evidence.

7. Conclusions and Discussion of Findings

The aim of this study was to examine whether good asset allocation by a CEO leads to superior stock returns and, if so, how one might be able to identify CEOs that are good

asset allocators. Employing US data from May 2001 to April 2019, we find that companies managed by CEOs who allocate company cash flows according to a value-investing-style seem to outperform in the stock market companies that are not managed by value investor CEOs. Findings are corroborated by out-of-sample tests (May 2019–April 2023) and results obtained by Cunningham (2020a, 2020b), who examined a similar question but from a different angle. When buying other businesses, value investor CEOs ensure that their consolidated operating margins remain high, as opposed to other firms managed by poor asset allocator CEOs who buy businesses that bring down operating margins, either because they overpay or due to an inability to materialize expected synergies. Buying businesses cheaply allows value investor CEOs to create value for their shareholders. As Mauboussin and Callahan (2014) explain, 70% of mergers fail to deliver the expected synergies. They produce survey results that show that the most common challenges companies cite for the inability to realize the expected synergies are underestimation of costs and complexities and flat-out overestimation of synergies. Nevertheless, this does not preclude companies that do not make significant acquisitions and hence keep goodwill/assets low to maintain a high operating margin and create value for their shareholders. The CEOs of those companies can also be good asset allocators in the sense that the reason goodwill to assets is low is simply because they have been unable to find cheap enough companies to buy. This finding also highlights the importance not only of goodwill/assets, as an asset allocation metric, but also of operating margins, even in situations where companies have relatively low goodwill/assets.

To the best of our knowledge, this is the first academic study to proxy asset allocation by combining high goodwill to assets in conjunction with high operating margin, and compare the stock market performance of good asset allocator companies/CEOs with those companies/CEOs that are not good capital allocators. Our results align closer with the thoughts and conclusions reached by practicing investors than those of academics who have not directly tested, and so were unable to reach a conclusion that good asset allocation is what contributes to good stock market performance by a company/CEO.

The paper's findings can help CEOs understand the importance of focusing their attention on asset allocation and mastering the skill. This is because asset allocation matters, despite having received little attention from finance academics. CEOs must hone their skill in asset allocation and learn to buy back shares when their companies' PEs are depressed. They must apply the same logic when acquiring other companies. This will ensure their investments will not fail, and the company's operating margin will remain at a high level followed by a strong stock market performance for the company's stock. As a result, future research should focus more directly on CEO asset allocation skills asset by examining share buyback and merger and acquisition company strategies.

The paper's findings can also help investors anticipate a company's future stock performance by identifying companies whose CEOs allocate assets like value investors. For example, as Table 2, Panel B shows, if a company, on average, has GWA of 41.03%, and OM of 21.38%, it is likely this firm would be at the top quartile in terms of stock return performance over at least the next three years. At the same time, if a firm has a low average GWA (i.e., 1.95%), its operating margins, on average, should be 24.46%, if it wants to achieve a similar performance as firms with high GWA. These are the companies an investor should buy and hold for the long run, as these are stocks Warren Buffett would like. Regression analysis added to the evidence that we can anticipate a company's future stock performance by identifying companies whose CEOs allocate assets like value investors.

The paper's findings can also help investors in another way. For example, investors tend to be skeptical about companies with high goodwill/assets. The rule of thumb is to beware of companies carrying goodwill on their balance sheets that is more than 25% of assets. Based on our findings, this should not be a problem as long as the company's operating margin has remained high (i.e., around 20%) and is rising.

Finally, the future stock return predictability of high (low) GWA and high (low) OM firms, found in this study, can help an investor develop trading strategies that can lead to superior stock price performance by effectively taking long positions in (shorting) firms that are (not) managed by value investor CEOs. A thorough analysis of such trading strategies, however, is left for future research.

Our methodology focused on indirect tests of asset allocation, as it has been challenging to be able to devise the best metric to identify good capital allocators and separate them from those who are not. In the future, we would like to focus more directly on asset allocation. We can do this in several ways. We can examine, for example, the multiples, such as P/E or P/B, at which a company buys back its own shares or the multiples at which a company acquires the shares of another company in a merger transaction. In a similar vein, another approach would be to look at the P/E or P/B at which a CEO (an insider) buys shares on his own account in an insider trade. A combination of all the above would be even better. This is because we know that value investors prefer to invest in stocks that have low P/E or P/B (see Athanassakos (2011)).

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Data Availability Statement: Data is contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

US companies in Q4 Goodwill/Assets and Q4 Operating Margin as at the end of 2019.

	Ticker	Company Name	Goodwill Over Assets	Operating Margin
1	VMC	VULCAN MATERIALS CO	29.74%	17.96%
2	MLM	MARTIN MARIETTA MATERIALS	23.66%	18.49%
3	FTDR	FRONTDOOR INC	40.08%	19.19%
4	KHC	KRAFT HEINZ CO	35.04%	20.38%
5	MDLZ	MONDELEZ INTERNATIONAL INC	32.30%	17.05%
6	HSY	HERSHEY CO	24.40%	21.49%
7	SMPL	SIMPLY GOOD FOODS COMPANY	41.29%	16.04%
8	MNST	MONSTER BEVERAGE CORP	25.86%	33.77%
9	MKC	MCCORMICK & CO INC	43.48%	18.30%
10	KDP	KEURIG DR PEPPER INC	40.74%	23.97%
11	MMM	3M CO	30.10%	21.99%
12	REYN	REYNOLDS CONSUMER PRODUCTS	45.17%	18.63%
13	LEE	LEE ENTERPRISES INC	45.08%	16.03%
14	DLX	DELUXE CORP	41.40%	15.80%
15	BCPC	BALCHEM CORP -CL B	45.34%	16.20%
16	MRK	MERCK & CO	23.02%	31.01%
17	PFE	PFIZER INC	35.02%	27.53%

	Ticker	Company Name	Goodwill Over Assets	Operating Margin
18	ZTS	ZOETIS INC	22.45%	33.67%
19	QDEL	QUIDEL CORP	37.00%	19.79%
20	VIVO	MERIDIAN BIOSCIENCE INC	27.42%	19.37%
21	AMGN	AMGEN INC	24.63%	41.61%
22	RGEN	REPLIGEN CORP	33.46%	18.53%
23	TECH	BIO-TECHNE CORP	38.88%	20.92%
24	ALXN	ALEXION PHARMACEUTICALS INC	28.71%	42.88%
25	CHD	CHURCH & DWIGHT INC	31.24%	19.52%
26	PG	PROCTER & GAMBLE CO	34.99%	21.52%
27	CLX	CLOROX CO/DE	31.10%	17.81%
28	CL	COLGATE-PALMOLIVE CO	23.33%	23.95%
29	WDFC	WD-40 CO	31.50%	19.46%
30	CCMP	CABOT MICROELECTRONICS CORP	31.39%	22.35%
31	CCF	CHASE CORP	26.62%	17.22%
32	SEE	SEALED AIR CORP	38.45%	15.51%
33	B	BARNES GROUP INC	34.07%	16.37%
34	HLIO	HELIOS TECHNOLOGIES INC	36.95%	17.05%
35	ENTG	ENTEGRIS INC	27.62%	18.57%
36	ITW	ILLINOIS TOOL WORKS	29.81%	24.11%
37	IEX	IDEX CORP	46.66%	24.26%
38	NDSN	NORDSON CORP	45.92%	22.16%
39	SGMS	SCIENTIFIC GAMES CORP	42.00%	17.15%
40	CSCO	CISCO SYSTEMS INC	34.29%	27.30%
41	ZBRA	ZEBRA TECHNOLOGIES CP -CL A	55.66%	16.28%
42	EVRI	EVERI HOLDINGS INC	41.84%	18.93%
43	MIDD	MIDDLEBY CORP	36.98%	17.66%
44	GNRC	GENERAC HOLDINGS INC	30.21%	16.88%
45	SWKS	SKYWORKS SOLUTIONS INC	24.58%	30.86%
46	ADI	ANALOG DEVICES	57.29%	30.15%
47	TXN	TEXAS INSTRUMENTS INC	24.21%	39.54%
48	LSCC	LATTICE SEMICONDUCTOR CORP	43.71%	15.68%
49	AVGO	BROADCOM INC	54.40%	20.06%
50	APH	AMPHENOL CORP	45.00%	19.80%
51	ALSN	ALLISON TRANSMISSION HLDGS	45.87%	32.88%
52	HEI	HEICO CORP	42.73%	22.36%
53	CW	CURTISS-WRIGHT CORP	30.99%	16.24%
54	TDG	TRANSDIGM GROUP INC	48.11%	40.12%
55	LHX	L3HARRIS TECHNOLOGIES INC	52.78%	17.01%

	Ticker	Company Name	Goodwill Over Assets	Operating Margin
56	RTN	RAYTHEON CO	43.05%	16.47%
57	FLIR	FLIR SYSTEMS INC	43.49%	16.88%
58	TDY	TELEDYNE TECHNOLOGIES INC	44.77%	15.62%
59	AME	AMETEK INC	41.11%	22.82%
60	EMR	EMERSON ELECTRIC CO	31.89%	16.98%
61	ROP	ROPER TECHNOLOGIES INC	59.72%	28.03%
62	DHR	DANAHER CORP	36.58%	18.77%
63	TMO	THERMO FISHER SCIENTIFIC INC	44.05%	16.68%
64	A	AGILENT TECHNOLOGIES INC	38.01%	20.05%
65	KLAC	KLA CORP	24.55%	31.29%
66	FTV	FORTIVE CORP	48.16%	16.48%
67	BDX	BECTON DICKINSON & CO	45.16%	16.74%
68	TFX	TELEFLEX INC	35.58%	19.84%
69	MSA	MSA SAFETY INC	25.10%	16.00%
70	SYK	STRYKER CORP	30.06%	23.14%
71	IART	INTEGRA LIFESCIENCES HOLDNGS	28.89%	17.19%
72	ZBH	ZIMMER BIOMET HOLDINGS INC	38.96%	18.90%
73	HOLX	HOLOGIC INC	39.80%	17.83%
74	ABT	ABBOTT LABORATORIES	34.17%	15.80%
75	BSX	BOSTON SCIENTIFIC CORP	33.29%	19.28%
76	RMD	RESMED INC	45.19%	24.39%
77	COO	COOPER COS INC (THE)	38.71%	22.10%
78	MPLX	MPLX LP	23.59%	37.69%
79	T	AT&T INC	26.51%	17.14%
80	CTL	CENTURYLINK INC	33.26%	16.87%
81	NUVR	NUVERA COMMUNICATIONS INC	30.76%	23.30%
82	Q1	QWEST CORP	44.57%	35.36%
83	OTEL	OTELCO INC	37.25%	23.65%
84	IHRT	IHEARTMEDIA INC	30.18%	17.17%
85	SIRI	SIRIUS XM HOLDINGS INC	34.47%	22.53%
86	TGNA	TEGNA INC	42.43%	25.96%
87	HMTV	HEMISPHERE MEDIA GROUP INC	33.95%	32.89%
88	5952B	UNIVISION COMMUNICATIONS INC	49.26%	28.88%
89	VIAB	VIACOM INC	50.09%	21.16%
90	CMCSA	COMCAST CORP	26.09%	19.56%
91	ATUS	ALTICE USA INC	23.87%	19.43%
92	DISCA	DISCOVERY INC	38.68%	28.60%

	Ticker	Company Name	Goodwill Over Assets	Operating Margin
93	MSGN	MSG NETWORKS INC	48.97%	42.99%
94	DIS	DISNEY (WALT) CO	41.39%	17.26%
95	VIAC	VIACOMCBS INC	34.29%	18.37%
96	CMCSA2	NBCUNIVERSAL MEDIA LLC	29.19%	19.48%
97	FE3	TOLEDO EDISON CO	37.58%	32.29%
98	SO7	SOUTHERN CO GAS	23.12%	23.34%
99	WM	WASTE MANAGEMENT INC	23.54%	18.14%
100	RSG	REPUBLIC SERVICES INC	51.29%	17.16%
101	PINC	PREMIER INC	34.27%	31.34%
102	IAA	IAA INC	25.16%	22.38%
103	WING	WINGSTOP INC	30.21%	21.49%
104	DNKN	DUNKIN' BRANDS GROUP INC	22.66%	31.59%
105	HLT	HILTON WORLDWIDE HOLDINGS	34.49%	16.71%
106	WH	WYNDHAM HOTELS & RESRTS	33.95%	23.59%
107	CSV	CARRIAGE SERVICES INC	35.25%	20.67%
108	LAMR1	LAMAR MEDIA CORP	32.11%	29.14%
109	SPGI	S&P GLOBAL INC	31.50%	48.34%
110	TRU	TRANSUNION	47.49%	23.04%
111	MCO	MOODY'S CORP	36.26%	43.30%
112	ROL	ROLLINS INC	32.84%	15.88%
113	URI	UNITED RENTALS INC	27.17%	24.02%
114	MINI	MOBILE MINI INC	33.70%	26.29%
115	ADBE	ADOBE INC	51.49%	29.25%
116	HQY	HEALTH EQUITY INC	52.01%	20.51%
117	CDK	CDK GLOBAL INC	45.23%	31.59%
118	MTCH	MATCH GROUP INC	51.14%	31.62%
119	TW	TRADEWEB MARKETS INC	52.89%	24.47%
120	FDS	FACTSET RESEARCH SYSTEMS INC	43.95%	30.52%
121	CTSH	COGNIZANT TECH SOLUTIONS	24.56%	16.76%
122	CSGP	COSTAR GROUP INC	48.83%	25.97%
123	EBAY	EBAY INC	28.35%	22.20%
124	STMP	STAMPS.COM INC	42.61%	16.36%
125	JCOM	J2 GLOBAL INC	46.58%	21.90%
126	AKAM	AKAMAI TECHNOLOGIES INC	22.84%	20.17%
127	MORN	MORNINGSTAR INC	43.83%	16.69%
128	TTGT	TECHTARGET INC	42.25%	16.97%
129	EBIX	EBIX INC	59.84%	26.05%
130	PRGS	PROGRESS SOFTWARE CORP	49.11%	17.46%
131	SNPS	SYNOPSYS INC	49.51%	16.34%

	Ticker	Company Name	Goodwill Over Assets	Operating Margin
132	INTU	INTUIT INC	26.34%	27.34%
133	SCPL	SCIPLAY CORP	31.38%	26.86%
134	CTXS	CITRIX SYSTEMS INC	40.98%	18.55%
135	SSNC	SS&C TECHNOLOGIES HLDGS INC	47.55%	19.74%
136	ANSS	ANSYS INC	49.87%	34.41%
137	SLP	SIMULATIONS PLUS INC	22.98%	31.35%
138	PCYG	PARK CITY GROUP INC	39.45%	18.85%
139	GSB	GLOBALSCAPE INC	36.78%	38.45%
140	ATVI	ACTIVISION BLIZZARD INC	49.20%	26.88%
141	JKHY	HENRY (JACK) & ASSOCIATES	30.53%	22.37%
142	FICO	FAIR ISAAC CORP	56.06%	21.86%
143	FFIV	F5 NETWORKS INC	31.42%	26.55%
144	FISV	FISERV INC	46.48%	16.40%
145	VRRM	VERRA MOBILITY CORP	41.50%	23.01%
146	GPN	GLOBAL PAYMENTS INC	53.42%	21.32%
147	WEX	WEX INC	29.42%	26.67%
148	FIS	FIDELITY NATIONAL INFO SVCS	62.34%	17.03%
149	BKI	BLACK KNIGHT INC	59.59%	25.06%
150	FLT	FLEETCOR TECHNOLOGIES INC	39.46%	46.74%
151	EVTC	EVERTEC INC	39.49%	29.65%
152	EEX	EMERALD HOLDING INC	66.61%	17.10%
153	NRC	NATIONAL RESEARCH CORP	52.34%	33.63%
154	MTN	VAIL RESORTS INC	36.33%	21.93%
155	SIX	SIX FLAGS ENTERTAINMENT CORP	22.88%	28.69%
156	DGX	QUEST DIAGNOSTICS INC	51.54%	15.79%
157	ATGE	ADTALEM GLOBAL EDUCATION INC	38.99%	17.40%
158	HON	HONEYWELL INTERNATIONAL INC	26.52%	20.15%
159	STZ	CONSTELLATION BRANDS	28.39%	32.35%
160	KMI	KINDER MORGAN INC	28.93%	29.74%
161	CX2	CLEVELAND ELECTRIC ILLUM	41.21%	27.10%
162	LSXMK	LIBERTY MEDIA SIRIUSXM GROUP	50.29%	21.21%
163	GWGH	GWG HOLDINGS INC	64.87%	38.20%
164	ZI	ZOOMINFO TECHNOLOGIES -REDH	61.90%	17.63%
165	NSCO	NESCO HOLDINGS INC	29.22%	16.78%
166	VNT	VONTIER CORP -REDH	40.65%	20.56%
167	VMW	VMWARE INC -CL A	35.48%	17.85%

Appendix B

Table A1. Summary statistics of various combinations of goodwill/assets (GWA) and operating margin (OM). The table also reports one-year, two-year, and three-year cumulative returns for various combinations of GWA and OM. Annual return data are for the period May 2019–April 2023. Balance sheet and income statement data are for the period December 2018–December 2019.

Panel A: Summary Statistics for Various Combinations of Goodwill/Assets (GWA) and Operating Margin (OM).									
	GW/Assets			Operating Margin					
	Mean	Median	STD	Mean	Median	STD			
Q4GWA & Q4OM	0.635	0.601	0.11	0.233	0.214	0.072			
Q4GWA & Q1OM	0.623	0.592	0.127	−0.195	−0.058	0.718			
Q1GWA & Q4OM	0.041	0.037	0.029	0.218	0.191	0.104			
Q1GWA & Q1OM	0.042	0.041	0.027	−0.438	−0.217	0.767			
Panel B: Summary Statistics for One Year, Two Year and Three-Year Cumulative Returns for Various Combinations of GWA and OM									
	One Year Return			Two Year Cumulative Return			Three Year Cumulative Return		
	Mean	Median	STD	Mean	Median	STD	Mean	Median	STD
Q4GWA & Q4OM	0.069	0.051	0.288	0.126	0.131	0.303	0.382	0.388	0.427
Q4GWA & Q1OM	−0.092	−0.214	0.612	−0.293	−0.531	0.753	−0.430	−0.803	0.871
Q1GWA & Q4OM	0.161	0.095	0.429	0.256	0.152	0.481	0.409	0.112	0.856
Q1GWA & Q1OM	−0.036	−0.212	0.635	−0.209	−0.372	0.614	−0.083	−0.263	0.733

Note: Fourth quartile of goodwill to assets (Q4GWA), fourth quartile operating margins (Q4OM), fourth quartile of goodwill to assets (Q4GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), fourth quartile of operating margins (Q4OM).

Table A2. T-statistic and chi-squared testing, respectively, the significance of the mean and median three-year cumulative return differences between various goodwill/assets (GWA) and operating margin (OM) combinations for the period May 2019–April 2023. Balance sheet and income statement data are for the period December 2018–December 2019.

2019–2022	t-Statistic	Chi-Squared
Q4GWA & Q4OM vs. Q4GWA & Q1OM	(3.99) *	(23.70) *
Q4GWA & Q4OM vs. Q1GWA & Q4OM	(−0.24)	(2.21)
Q4GWA & Q4OM vs. Q1WA & Q1OM	(0.85)	(6.57) *
Q4GWA & Q1OM vs. Q1GWA & Q4OM	(−3.90) *	(18.78) *
Q4GWA & Q1OM vs. Q1GWA & Q1OM	(−2.07) **	(5.15) **
Q1GWA & Q4OM vs. Q1GWA & Q1OM	(0.93)	(5.89) **

* Signifies 1% level of significance. ** Signifies 5% level of significance. Note: Fourth quartile of goodwill to assets (Q4GWA), fourth quartile operating margins (Q4OM), fourth quartile of goodwill to assets (Q4GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), first quartile of operating margins (Q1OM), first quartile of goodwill to assets (Q1GWA), fourth quartile of operating margins (Q4OM).

Notes

- ¹ Mauboussin and Callahan (2014) ask the following question: what factors should we consider judging whether capital allocation creates value? They indicate that industry is a good starting point as companies that invest in industries with high return on investing capital (an important component of which is operating margin) and good growth prospects are more likely to create value, which will eventually reflected in the company's stock price.

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Article

Diverging Paths: CEO Regulatory Focus, Corporate Social Responsibility, and the Enigma of Firm Performance

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Abstract: Regulatory focus theory theorizes that there are two distinct dispositional foci of self-regulation (promotion focus and prevention focus) that impact individuals' motivational tendencies to achieve their decision-making processes. This study integrates regulatory focus theory with upper echelons theory to investigate how CEO regulatory focus (i.e., higher degrees of promotion focus relative to prevention focus) influences corporate strategic outcomes, particularly regarding the pursuit of corporate social responsibility (CSR) performance and firm performance. This study uses data collected from the annual reports of S&P 1500 firms in the US from 2000 to 2018. Results show a negative association between CEOs who are predominantly promotion-focused and CSR performance. This negative association is diminished in firms with better corporate governance (i.e., higher CEO equity compensation and greater institutional ownership). The results also show that CSR plays a mediating role in the relationship between CEO regulatory focus and firm performance. These findings not only contribute to the existing literature by highlighting the role of CEO regulatory focus in shaping CSR initiatives but also shed light on its implications for firm performance.

Keywords: CEO regulatory focus; corporate social responsibility (CSR); firm performance (FP); mediation; upper echelons

1. Introduction

Firm performance (FP) is a central theme of corporate finance and serves as a crucial driver of firm growth. FP reflects the effectiveness of management in fulfilling their responsibilities to shareholders (Jensen and Meckling 1976; Kruse et al. 2023). Today, top executives face mounting pressure for their firms to prioritize “doing good” by enhancing societal well-being alongside profit maximization. Not surprisingly, this shift in corporate ethos aligns with a growing desire among many investors to engage in sustainable investments (Fatemi et al. 2015). For example, in 2021, USD 8.4 trillion (representing 13 percent) of assets managed in the US were branded as sustainable investments (US SIF 2022). One of the most debated questions in the CSR/sustainability literature is whether management decisions regarding corporate responsibility contribute to improving FP (Giannopoulos et al. 2024; Gillan et al. 2021).

Advancing this literature, the investigation of the antecedents and consequences of CSR has expanded greatly (for a review, see Christensen et al. 2021), particularly in the last two decades. For example, scholars have studied the antecedents of CSR and focused largely on the external drivers, such as the influences of media press (Kölbel et al. 2017), analyst stock recommendations (Lee et al. 2018), and legal mandates (Jackson et al. 2020) on CSR. Conversely, research on the internal drivers of CSR has been somewhat limited. The scant work on the internal drivers has focused primarily on firm characteristics (Moussu and Ohana 2016), and board characteristics (Beji et al. 2021). We know very little about

whether a firm's propensity to engage in CSR is influenced by CEOs' personal characteristics. Indeed, CSR refers to management's obligation to set policies, make decisions, and follow courses of action that are desirable in terms of the values and objectives of society (Mosley et al. 1996).

In this study, we address the important research gaps in the literature by investigating the influence of one specific psychological trait of CEOs, represented by regulatory focus, on a firm's CSR performance and FP. We aim to answer two key research questions. First, does a CEO's regulatory focus influence the firm's CSR performance? Second, does CSR mediate the relationship between the firm's CEO regulatory focus and FP?

We first examine the impact of CEO regulatory focus on CSR, mainly drawing from upper echelons and regulatory focus theories. Upper echelons theory predicts that CEOs, as leaders, are the most powerful actors within organizations and can influence corporate strategic decisions and outcomes (Hambrick and Mason 1984). While research using upper echelons theory is widespread, less attention has been paid to exploring the psychological traits of CEOs (Christensen et al. 2021). Empirical studies in this regard have shown how the self-concept attributes of CEOs affect strategic outcomes, particularly CSR performance, including CEO hubris (Tang et al. 2018) and narcissism (Al-Shammari et al. 2019). As stated in Gamache et al. (2020, p. 1309), regulatory focus has a "more proximal influence" on behavior compared with hubris and narcissism characteristics. A relatively small body of research has shifted the attention more toward the impact of motivational attributes in the form of CEOs' regulatory focus on corporate actions such as the pursuit of corporate acquisitions, innovation, strategic change, and myopic marketing management (Chung and Low 2022; Gamache et al. 2015; Jiang et al. 2020; Kashmiri et al. 2019). Surprisingly, research that investigates whether CEO regulatory focus impacts a firm's CSR performance remains scant. This omission indicates that the role of CEO regulatory focus in corporate strategy is understated.

Regulatory focus theory posits that there are two dispositional foci of self-regulation (promotion focus and prevention focus) that impact individuals' motivation to achieve strategic goals (Higgins 1997; Higgins and Pinelli 2020). Promotion-focused individuals are primarily concerned with advancement and accomplishment and are motivated to attain gains—these motivations are based on ideals and what could be. In contrast, prevention-focused individuals are concerned with protection and responsibility and are motivated to avoid losses—these motivations are based on ought and what should be (Lanaj et al. 2012). Both promotion and prevention foci independently shape inclinations of how individuals are motivated to pursue goals. Therefore, the competing motivational orientation poses a question of how CEOs are driven to pursue CSR to satisfy their vanity through a promotion or prevention focus.

In addition, it is likely that different stakeholders are perceived differently by CEOs based on their relevancy and importance. There is a growing awareness in the literature that firms may engage in some CSR activities (externally oriented CSR activities) more than in other activities (internally oriented CSR activities) (Al-Shammari et al. 2019). Limited research (Chang et al. 2021) has examined whether CEO regulatory focus is associated with CSR primarily through external CSR or internal CSR (or both). We aim to shed light on this overlooked lacuna.

We next examine the indirect effect of CEO regulatory focus on FP via CSR activities. Presently, how CEO regulatory focus impacts FP has been largely neglected in empirical studies, and thus, more attention is warranted (Chung and Low 2022). To the best of our knowledge, the literature has not yet investigated the mediating role of possible mechanisms, particularly CSR, in the relationship between CEO regulatory focus and FP. Despite the fact that the relationship between CSR and FP has been well investigated in the literature, there is inconsistency with previous findings, revealing positive (e.g., Albuquerque et al. 2019; Fatemi et al. 2015), negative (e.g., Giannopoulos et al. 2024), or insignificant relationships (e.g., Suteja et al. 2023), drawing from the competing theories of stakeholder theory and agency theory. Consequently, a robust answer about how CSR

affects FP is imperative for management practices. Scholars have suggested that the mixed results regarding the effect of CSR on FP may be contingent on other factors, which have been largely omitted in empirical studies (Brooks and Oikonomou 2018; Orlitzky et al. 2003). Hence, our aim is to investigate whether the impact of CEO regulatory focus on FP is mediated by the firms engaging more in CSR activities.

We draw on a large sample of US public firms, spanning from 2000 to 2018, to test our research questions. We focus on the US market for two main reasons. First, despite the global increase in CSR reporting, the standalone CSR reporting in the US remains limited. For example, SASB (2017) noted in its 2017 report on CSR reporting that although 83 percent of companies registered with the US Securities and Exchange Commission (SEC) disclose some sustainability information in their regulatory filings, much of this information is considered voluntary. Thus, investors often express concerns about the lack of comparable and verifiable information in this regard (Christensen et al. 2021). This information gap makes CSR of particular interest to both academics and practitioners. Second, the US is well-developed and provides detailed regulatory filings (Form 10-K), including the CEO letter to shareholders. Numerous studies have investigated the importance of CEO regulatory focus in corporate outcomes (e.g., Gamache et al. 2015). The US market therefore provides an ideal setting for our study and for future studies aiming to link a CEO's regulatory focus to a firm's CSR and its firm value. To measure CEO regulatory focus, we use the CEO promotion focus predominance (i.e., higher degrees of promotion-focus relative to prevention-focus), as introduced by Gamache et al. (2015) and measured by Chung and Low (2022) and Kashmiri et al. (2019). We find that predominantly promotion-focused CEOs are negatively associated with CSR performance; in particular, it is negatively related to external CSR activities but insignificantly related to internal CSR activities. We also show that the negative impact of CEO promotion focus predominance on FP is partially mediated by firms engaging more in CSR.

We extend our results by performing cross-sectional tests to provide further evidence on whether this association is moderated by internal corporate governance (as proxied by CEO equity compensation) and external corporate governance (as proxied by institutional ownership). We are drawing on the central paradigm of ought versus ideal goals, as the motivational level of an individual's regulatory focus can be affected by situational factors (Brockner and Higgins 2001). We expect that the negative impact of predominantly promotion-focused CEOs on CSR will be weaker for firms with better corporate governance (as proxied by higher CEO equity compensation and higher institutional ownership). The cross-sectional results are consistent with our expectations.

Our study makes three important contributions. First, we expand research on regulatory focus theory and upper echelons theory by examining how CEO promotion focus predominance impacts a firm's overall, internal, and external CSR. Such a contribution is important as it reveals a potential motivational tension between the pursuit of CSR performance as a strategic action that is more prevention-focused and the pursuit of other types of strategic actions (e.g., mergers and acquisitions) that are promotion-focused. Second, while previous research on the influence of CEO regulatory focus on firm outcomes has primarily investigated the main effect of this relationship, we explore the role of corporate governance factors (CEO equity compensation and institutional ownership) in moderating the association between CEO promotion focus predominance and CSR. Our results provide important insights for the board of directors on using these factors to monitor and control CEO behavior. Finally, while scholars have devoted substantial attention to investigating the impact of CSR on FP, there is limited research that sheds light on how CEO regulatory focus is impacted in this relationship. We theorize and find empirical support that CSR mediates the association between CEO promotion focus predominance and FP. Our results provide a more complete picture of the CSR–FP relationship and a nuanced understanding of the mediating mechanism linking CEO regulatory focus to firm financial performance.

The rest of this paper is structured as follows. Section 2 discusses the literature and hypotheses development. Section 3 describes data and variables used in the research design.

Section 4 presents the empirical results. The final section discusses and concludes the paper with implications and areas for further research.

2. Literature and Hypotheses

2.1. Literature on CSR and Regulatory Focus

CSR has been defined as “situations where the firm goes beyond compliance and engages in actions that appear to further some social good, beyond the interests of the firm” (McWilliams et al. 2006, p. 1). Prior studies have primarily revealed the determinants of CSR, focusing on external factors such as media press (Kölbel et al. 2017) and legal mandates (Jackson et al. 2020). Researchers have begun to explore the idea that CSR might hinge on within-firm antecedents of CSR (e.g., Beji et al. 2021; Bouchet et al. 2022). CSR performance will be expected to be sensitive to the characteristics of CEOs, with its theoretical foundations in two distinct streams of research.

First, according to agency theory (Jensen and Meckling 1976), an agency conflict arises between the principal (i.e., shareholders) and the agent (i.e., managers) when managers prioritize their own interests over those of the company. For instance, managers bear relatively high costs and risks associated with allocating resources to social investments (van Dierendonck 2011). The agency problem is evident in situations where firm managers have little or no financial interest in the company, as noted by Fama (1980). In response to these challenges, companies increasingly are seeking leadership that emphasizes ethics and concerns for society, in part as a reaction to scandals involving self-serving corporate management (Peterson et al. 2012). CEOs play a central role in this form of leadership. They set the tone for the company through the policies they implement, the vision they articulate, and the decisions they make (Finkelstein et al. 2009).

Second, according to upper echelons theory (Hambrick and Mason 1984), the attributes and characteristics of the top management team (CEO in particular) are the key drivers of the firm’s decision-making processes (Arslan et al. 2022). From this perspective, how CEOs act on information and make decisions on behalf of the company is uniquely determined by a combination of their individual traits, experiences, and cognitive frameworks. While the work of upper echelons emphasizes the importance of CEO characteristics in shaping corporate outcomes, there has been less focus on their role in CSR performance, despite CSR being essential to the company’s sustainable development (Kiriū and Nozaki 2020). By overlooking the role of CEO characteristics in CSR performance, firms may miss the opportunities to leverage leadership attributes for enhancing their social and environmental impact.

Much of the prior research within the upper echelon theory has traditionally relied on demographic variables as proxies for the subjective beliefs and values of CEOs to study their effects on corporate outcomes (Finkelstein et al. 2009; Yim 2013). Relatively less consideration has been devoted to the psychological traits of CEOs, such as hubris (Tang et al. 2018), narcissism (Al-Shammari et al. 2019), and overconfidence (Malmendier and Tate 2005), in explaining their decision-making behaviors, including their engagement in CSR activities. One such psychological characteristic that has recently gained attention among upper echelons researchers is CEO regulatory focus: an attribute reflecting the motivation individuals have for attaining gains (promotion focus) and/or avoiding losses (prevention focus) (Gamache et al. 2015; Kashmiri et al. 2019). Research suggests that CEOs’ regulatory focus directly affects their level of motivation and tolerance for uncertainty, which, in turn, can significantly impact their strategic decisions and outcomes (e.g., Gamache et al. 2015; Huang and Zheng 2022). By extending these insights to the logic of upper echelons theory, we focus on CEOs’ psychological characteristics, as indicated by CEO regulatory focus.

Indeed, there is a rich literature on regulatory focus. Higgins (1997, 1998) introduced the regulatory focus theory and suggested that individuals are motivated to pursue their goals through two internal mechanisms: a promotion focus and a prevention focus. Although both regulatory foci motivate people to move toward their desired end-states, they do so through different cognitive and behavioral processes (Gamache et al. 2015; Higgins

and Pinelli 2020). Self-regulation, through a promotion focus, involves the presence or absence of positive outcomes in relation to nurturance needs (Higgins 1998) and directs individuals' attention towards the accomplishment of goals that reflect their hopes, wishes, and aspirations (Chan 2021). Individuals who are predominantly promotion-focused (i.e., those who have higher degrees of promotion focus relative to prevention focus) tend to be more sensitive towards perceived opportunities for gain and seek to attain strategic goals aligned to the ideal self.

In contrast, self-regulation, through a prevention focus, involves the presence or absence of negative outcomes in relation to security needs and directs individuals' attention towards the accomplishment of goals that reflect their duties, obligations, and responsibilities (Chan 2021; Higgins 1997). Unlike a promotion focus that is aligned to the ideal self, a prevention focus is aligned to the ought self, which emphasizes attributes that individuals believe they should possess based on moral obligations and normative standards. Thus, individuals who are predominantly prevention-focused (i.e., those who have higher degrees of prevention focus relative to promotion focus) seek to minimize losses and maximize non-losses through the adoption of vigilance strategies.

Prior evidence has demonstrated that different regulatory foci of CEOs have different firm-level responses to various types of strategic decisions, including firm acquisitions (Gamache et al. 2015), strategic change (Huang and Zheng 2022), internationalization (Biru et al. 2023), and carbon emission performance (Wagner and Fischer-Kreer 2024). Surprisingly, less attention has been paid to exploring the implications of CEO regulatory focus for corporate ethical conduct (e.g., CSR). One exception, a study by Chang et al. (2021), examines the direct link between CEO regulatory focus and CSR. They find a positive association between CEO promotion focus and CSR but an insignificant association between CEO prevention focus and CSR. However, their findings do not explain the possibility that CSR might mediate the effect of CEO regulatory focus on FP. Thus, understanding the mediating effect of CSR on the relation between CEO regulatory focus and FP remains an unresolved issue. To gain a deeper understanding of how these traits shape corporate decisions, we aim to extend their study and examine the impact of CEOs' promotion focus relative to prevention focus on firms' CSR and financial performance.

2.2. CEO's Promotion Focus Relative to Prevention Focus and CSR

We theorize that firms led by CEOs who are predominantly promotion-focused (i.e., CEOs have a greater degree of promotion focus relative to prevention focus) are likely to engage less in CSR for the following reasons. On one hand, we propose that CEOs with greater promotion focus (relative to prevention focus) may prioritize activities that directly contribute to financial gains. They tend to pay much more attention to over-investing in these profit-oriented activities (Gamache et al. 2015), leaving fewer resources to be allocated towards fostering their firm's engagement in any form of CSR initiatives. This is because CSR initiatives often require long-term investments and may not directly lead to short-term gains. Promotion-focused CEOs, who exhibit a disposition towards the maximization of gains aligned to their aspirations, will perceive CSR activities as non-gains; thus, they will seek to minimize their focus on pursuing CSR activities (Crowe and Higgins 1997). Under the leadership of predominantly promotion-focused CEOs, CSR activities might take a backseat in the allocation of resources, which leads to lower CSR performance.

In addition, predominantly promotion-focused CEOs will be rendered myopic to the pursuit of CSR performance due to a lack of moral attentiveness (Hafenbrädl and Waeger 2017). CEOs with low moral attentiveness will be less concerned about the ethical implications of their actions and are more focused on achieving their personal goals. This lack of moral attentiveness could lead to a disconnect between the firm's CSR activities and its genuine commitment to social and environmental responsibility.

On the other hand, we propose that CEOs with greater prevention focus (relative to promotion focus) would be positively associated with CSR because they place more emphasis on their duties and responsibilities to shareholders (Gamache et al. 2020). They

will pay more attention to their job and prioritize gaining the trust of the firm's shareholders and other stakeholders (Gamache et al. 2015). From a motivational point of view, these CEOs are more likely to engage in CSR, as they perceive CSR as a business strategy that improves firm performance and aligns their interests with those of shareholders. They are more likely to endorse the firm's social engagement and its pluralistic responsibility to multiple stakeholders through the active pursuit of CSR activities.

A prevention-focused orientation is also characterized by a strong desire for avoiding losses and preventing mistakes (Gamache et al. 2015). Predominantly prevention-focused CEOs are driven by security and responsibility, make decisions with due diligence, and are sensitive to negative information (Crowe and Higgins 1997). Prior studies suggest that high moral values are directly linked to one's engagement in CSR (Shao et al. 2008). Following this line of research, predominantly prevention-focused CEOs are likely to engage more in CSR, as they feel the need to minimize losses in relation to their personal moral obligations, which are tethered to an ought goal. They also actively communicate to keep the board and shareholders informed, ensuring effective board monitoring (Sonnenfeld et al. 2013). Recognizing the importance of CSR in mitigating the potential negative consequences of the company's reputation and enhancing long-term sustainability, it is expected that predominantly prevention-focused CEOs are more likely to implement CSR strategies. For instance, they engage in CSR to reduce environmental impact, improve employee well-being, or enhance community engagement to prevent any risks associated with neglecting social and environmental responsibilities.

Based on the above analysis, we propose the following hypothesis:

H1. *The greater a CEO's level of promotion focus relative to the CEO's prevention focus, the lower the firm's CSR performance is likely to be.*

2.3. CEO's Promotion Focus Relative to Prevention Focus, CSR, and FP

In addition to the antecedents of CSR, researchers have also examined the consequences of CSR and used several theoretical frameworks for the perspective of CSR, mainly drawn from stakeholder theory and agency theory (e.g., Gul et al. 2020). According to the stakeholder theory conceptualized by Freeman (1984), firms fulfill their CSR due to altruism and societal well-being and promote their CSR to maintain a good citizen image or fulfill the moral obligations of enterprises instead of just monetary returns. Consistent with the stakeholder theory, a plethora of research indicates that firms engage in CSR to improve their social image and status, obtain reputational capital, and enhance firm value (e.g., Bardos et al. 2020; Yu and Zheng 2020). Aguinis and Glavas (2019) summarize that many firms aim to use CSR to build a solid relationship with their broad scope of stakeholders and ensure survivability and the triple bottom line of economic, social, and environmental performance.

Alternatively, agency theory, initiated by Friedman (1970), suggests that firms perform CSR due to their own self-interest and fulfill certain goals. In line with the agency theory, CSR has been viewed with skepticism from some researchers who believe that such firms' motives are less than sincere, raising the concerns of "greenwashing" or "window dressing", where firms improve CSR for purely presentational reasons while hiding poor performance (Brooks and Oikonomou 2018; Owen et al. 2001). There is evidence that CSR is a misappropriation or misallocation of a firm's resources and is equivalent to theft from the firm's shareholders (Masulis and Reza 2015).

Thus, understanding the impact of CSR on FP is important because maximizing firm value is the main goal of the company (Jensen and Meckling 1976). Despite many empirical studies that have examined the relationship between CSR/ESG and FP, the results remain inconsistent (for a review, see Brooks and Oikonomou 2018; Christensen et al. 2021). Some studies find a positive relationship (e.g., Albuquerque et al. 2019), while others report a negative (e.g., Buchanan et al. 2018; Giannopoulos et al. 2024) or no relationship (e.g., Suteja et al. 2023). From a shareholder's perspective, the ultimate test of CSR activities is whether they can help to enhance firm value (Houqe and Khan 2023). Following this flow

of thought, several studies find a positive effect of CSR on FP (e.g., Albuquerque et al. 2019; Fatemi et al. 2015), suggesting that CSR activities positively impact the firm's reputations, stakeholder relationships, and brand image (Hahn and Kühnen 2013). In line with these studies, we expect a positive association between CSR and FP.

In an attempt to open the black box in the association between CSR and FP, we next examine whether CSR mediates the impact of CEO promotion focus predominance on FP. Surprisingly, there has been a dearth of research examining the relationship between CEO regulatory focus and FP. A study by Chung and Low (2022) is one of the few that explores this association and shows that firms led by predominantly promotion-focused CEOs are associated with poorer FP. Based on this premise, we expect that CEOs with greater promotion focus (relative to prevention focus) tend to focus on attaining gains and avoiding losses. This may lead them to take excessive risks in the pursuit of ambitious goals, which can result in financial loss for the company. They might also be more risk-averse when comes to innovation, preferring to maintain tried-and-tested methods rather than investing in innovative strategies such as R&D that could drive long-term financial growth (Kashmiri et al. 2019). Thus, a negative association between CEO promotion focus predominance and FP is expected.

Taken together, we expect the firm's CSR performance to mediate the relationship or path between its CEO's promotion focus predominance and the firm's FP. In other words, CEO promotion focus predominance will have a negative impact on FP and CSR. Since CSR typically has a positive impact on FP, we argue that CSR acts as a mediator in the association between CEO promotion focus predominance and FP, thus reducing the expected negative impact of CEO promotion focus predominance on FP. Therefore, we propose the following hypothesis:

H2. *CSR mediates the association between a CEO's level of promotion focus relative to the CEO's prevention focus and FP.*

Figure 1 presents our conceptual model that positions CSR as a mediator of the relationship between CEO regulatory focus and FP.

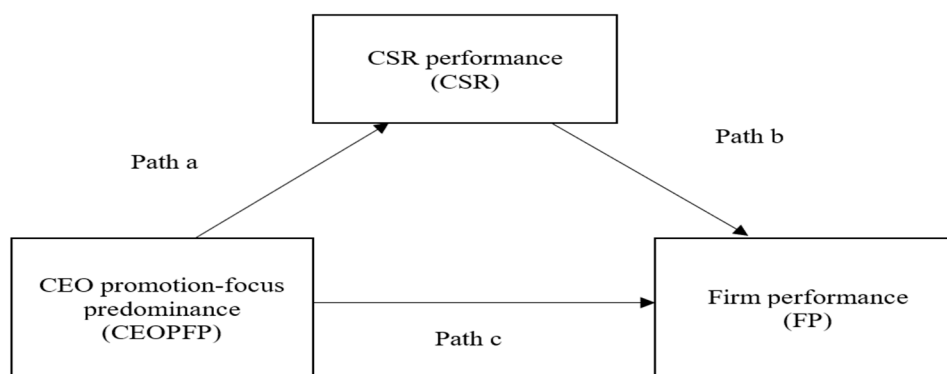


Figure 1. Conceptual model.

3. Data and Variables

3.1. Data

Our sample was drawn from several sources. First, since our study is focused on the antecedents and outcomes of CSR, we began by considering all US public firms with non-missing CSR information from MSCI ESG KLD STAT (formerly known as Kinder Lydenburg Domini (KLD), USA), spanning from 2000 to 2018 (the latest data was ended on 1 January 2019). Second, to obtain CEO regulatory focus, we derived a sample of S&P 1500 firms on the Russell 3000 index, plus others listed on the Dun and Bradstreet database, to collect the letters from CEOs to shareholders in annual reports. Finally, we collected firm-level financial data from Compustat, stock price data from the Center for Research in Security Prices (CRSP), CEO-level data from ExecuComp, board data from

Institutional Shareholder Services (ISS), and institutional ownership data from Thomson Reuters Institutional Holdings (13F). We then dropped observations with missing information for calculating our variables used in this study. This left a final sample of 7555 to 8106 firm–year observations from 1053 unique firms over the sample period.

3.2. Variables of Interest

3.2.1. CSR Performance (CSR)

We computed CSR performance using the *KLD* database that has been broadly used in many CSR studies. Following Feng et al. (2023), we focused on five main categories of CSR activities: community, diversity, employee relations, environmental, and product. Under each category, CSR is related to two subcategories—strengths and concerns—that are related to the diverse set of CSR engagement. We calculated a firm’s overall CSR score using the total strengths minus the concerns across the five categories in the *KLD* database.

3.2.2. Firm Performance (FP)

We defined FP using Tobin’s q , which has been widely used in the literature (Bardos et al. 2020; Buchanan et al. 2018). We measured *Tobin’s q* as the ratio of market value of total equity plus the liquidating values of preferred stocks and total debt to the book value of total assets.

3.2.3. CEO Promotion Focus Relative to Prevention Focus (CEOPFP)

Our *CEOPFP* variable reflected the degree of a CEO’s promotion focus relative to prevention focus. To measure this variable, we followed prior research (Chung and Low 2022; Gamache et al. 2015; Kashmiri et al. 2019) and conducted a content analysis¹ of CEO letters to their firm’s shareholders in annual reports. We analyzed CEO letters to shareholders using specific dictionaries of promotion- and prevention-related words that were developed by Gamache et al. (2015). To ensure high coding reliability, we used Linguistic Inquiry and Word Count (LIWC) software to detect the presence of promotion- and prevention-related words in each CEO letter extracted (see Supplementary Appendix A).

We first measured CEO promotion-focus and prevention-focus using a percentage of related words within each letter, respectively. We then subtracted the average percentage of prevention-related words from the average percentage of promotion-related words in each CEO’s letters and used this difference to reflect *CEOPFP* (the degree of promotion-focus relative to prevention-focus). A positive (negative) value indicated that the CEO is predominately promotion-focused (prevention-focused). Further, we followed the suggestion of Chung and Low (2022) and standardized the proportion of sentences with promotion-related words and the proportion with prevention-related words to have a mean of zero and standard deviation of one first before taking the difference. The motivation for standardization is because there are many more sentences with promotion-related words than prevention-related words, and the standard deviation for the former is also much higher.

3.3. Control Variables

We included several control variables that may impact CSR (Al-Shammari et al. 2019; Buchanan et al. 2018). For firm characteristics, we controlled firm size (*SIZE*) and age (*AGE*) since larger and older firms may be more inclined to engage in CSR compared to smaller and younger firms. Cash ratio (*CASH*) was included to control the potential impact of the degree of liquidity on its engagement in CSR. We included two controls that account for firm profitability as indicated by growth in sales (*SGROW*) and *ROA*. We also included two controls that account for the firm’s potential risk, as proxied by leverage (*LEV*) and earnings volatility (*VOLAT*). To account for other strategic actions that may impact CSR, such as innovation, we controlled for R&D intensity (*RDINT*) and capital intensity (*CAPINT*).

CEO characteristics also play an important role in determining CSR. We controlled for CEO gender (*CEOGENDER*), as the perceived importance of CSR may vary among

different groups between male and female CEOs (Chen et al. 2020a). We controlled CEO age (*CEOAGE*) and tenure (*CEOTENURE*) to account for the potential effect of CEO discretion characteristics that may motivate CEOs' decisions to pursue CSR. We also controlled for CEO overconfidence (*CEOOVER*) since these CEOs are likely to be confident about their superior interpretation and understanding of strategic actions (Gul et al. 2020). Furthermore, we included board size (*BSIZE*) and board independence (*BINDP*) to account for the potential effect of board governance on CSR. Variable definitions are shown in Table 1.

Table 1. Variable definitions.

Variables	Definition
CEO promotion focus predominance (<i>CEOPFP</i>)	(Number of sentences in the CEO annual letter containing words relating to promotion focus/total number of sentences in the annual letter)—(Number of sentences in the CEO annual letter containing words relating to prevention focus/total number of sentences in the annual letter). Proportions of sentences with promotion- and prevention-related words are each standardized to have a mean of 0 and standard deviation of 1.
CSR	Total CSR strengths minus total CSR concerns across the five categories of KLD ratings: community, diversity, employee relations, environment, and product
External CSR	Total strengths minus total concerns of the community and environment categories
Internal CSR	Total strengths minus total concerns of the employee relations and diversity categories
Firm performance (FP)	(Market value of total equity + liquidating values of preferred stocks + total debt)/total assets
Firm size (SIZE)	Natural logarithm of total sales
Firm age (AGE)	Natural logarithm of the number of years the firm was listed in Compustat
Cash ratio (CASH)	(Cash and cash equivalents)/total assets
Sales growth (SGROW)	Change in log of sales between year t and year t–1
Return on assets (ROA)	Operating income/total assets
Leverage (LEV)	Total debt/total assets
Earnings volatility (VOLAT)	Standard deviation of earnings over the past five years
R&D intensity (RDINT)	R&D expenditure/total sales
Capital intensity (CAPINT)	Capital expenditure/total sales
CEO gender (CEOGENDER)	1 if the CEO is a male CEO, and 0 otherwise
CEO age (CEOAGE)	Natural logarithm of CEO age
CEO tenure (CEOTENURE)	Natural logarithm of the number of years that the CEO has been serving the company
CEO overconfidence (CEOOVER)	1 if the CEO holds stock options that are at least 67% in cash, and 0 otherwise
Board size (BSIZE)	Number of directors sitting on the board
Board independence (BINDP)	The percentage of independent directors on the board
CEO equity compensation (CEOEQUITY)	(CEO's annual restricted stocks and stock options)/total compensation
Institutional ownership (INSOWN)	The percentage of shares held by institutional investors for the firm to the total shares outstanding

3.4. Descriptive Statistics

Table 2 presents the descriptive statistics and correlations of the regression variables. The mean value of CSR score is 1.30, which is comparable to those shown in prior studies (Chen et al. 2020b). The mean value of *CEOPFP* is similar to that reported in Chung and Low (2022). We also calculate variance inflation factors (VIF) for each variable to test for multicollinearity. The mean VIF value is 1.23 (ranges from 1.01 to 1.69), indicating that multicollinearity is not a concern for our sample.

Table 2. Descriptive statistics and correlation matrix.

Variables	Mean	S.D.	P5	P50	P95	1	2	3	4	5	6	7	8	9	10
1. CSR	1.30	1.67	0.21	0.79	5.21	1.00									
2. FP	1.94	1.72	0.86	1.45	4.63	0.02	1.00								
3. CEOPFP	0.00	0.80	−1.42	0.05	1.23	−0.08 *	−0.01	0.79 *							
4. CEOEBC	0.35	0.26	0.07	0.25	0.96	−0.15 *	−0.03	−0.08 *	1.00						
5. INSOWN	0.72	0.28	0.14	0.79	1.00	−0.06 *	0.03 *	−0.01	−0.17 *	1.00					
6. SIZE	4.69	12.18	0.03	0.91	21.09	0.41 *	−0.02	0.02	−0.15 *	−0.01	1.00				
7. AGE	2.48	0.79	0.00	2.71	3.26	0.08 *	−0.09 *	0.07 *	0.00	0.05 *	0.02	1.00			
8. CASH	0.15	0.18	0.00	0.08	0.57	0.38 *	−0.03 *	0.04 *	0.03	−0.07 *	−0.05 *	1.00			
9. SGROW	0.11	0.29	−0.24	0.07	0.57	−0.07 *	0.18 *	0.04 *	0.04 *	0.00	−0.03 *	−0.22 *	0.09 *	1.00	
10. ROA	0.10	0.13	−0.11	0.11	0.27	0.10 *	0.06 *	0.11 *	−0.04 *	0.07 *	0.08 *	0.06 *	−0.31 *	0.02	1.00
11. LEV	0.23	0.20	0.00	0.20	0.61	0.03	−0.17 *	−0.05 *	−0.13 *	0.13 *	0.04 *	−0.09 *	−0.38 *	−0.01	0.05 *
12. VOLAT	0.15	0.29	0.00	0.03	1.00	−0.04 *	0.14 *	0.08 *	−0.08 *	−0.03 *	0.01	−0.67 *	0.13 *	0.20 *	−0.14 *
13. RDINT	0.05	0.15	0.00	0.00	0.22	0.00	0.29 *	0.04 *	−0.03	0.04 *	−0.05 *	−0.07 *	0.59 *	0.13 *	−0.26 *
14. CAPINT	0.21	0.36	0.00	0.04	1.00	−0.03 *	0.05 *	−0.07 *	−0.06 *	−0.08 *	0.04 *	−0.46 *	−0.07 *	0.14 *	0.04 *
15. CEOGENDER	0.97	0.17	1.00	1.00	1.00	−0.02	0.00	0.04 *	−0.01	−0.03	0.03	0.01	0.02	−0.01	
16. CEOAGE	4.04	0.13	3.83	4.04	4.26	0.00	−0.04 *	−0.02	0.06 *	−0.07 *	0.03	0.06 *	−0.06 *	−0.04 *	0.00
17. CEOTENURE	2.55	0.53	1.61	2.64	3.30	0.06 *	−0.01	−0.01	0.01	−0.08 *	0.05 *	0.26 *	−0.04 *	−0.03	0.05 *
18. CEOOVER	0.49	0.50	0.00	0.00	1.00	−0.16 *	0.23 *	0.00	0.02	0.02	−0.05 *	−0.10 *	0.06 *	0.16 *	0.17 *
19. BSIZE	9.20	1.32	7.00	9.00	12.00	0.25 *	−0.06 *	−0.03 *	−0.13 *	−0.03 *	0.27 *	0.09 *	−0.12 *	−0.04 *	0.01
20. BINDP	0.36	0.40	0.00	0.00	0.91	0.05 *	−0.03 *	−0.07 *	−0.27 *	0.10 *	0.08 *	0.43 *	−0.01	−0.13 *	0.04 *
Variables						11	12	13	14	15	15	17	18	19	20
11. LEV						1.00									
12. VOLAT						0.03 *	1.00								
13. RDINT						−0.12 *	0.11 *	1.00							
14. CAPINT						0.04 *	0.50 *	−0.10 *	1.00						
15. CEOGENDER						−0.03	−0.03	0.02	−0.01	1.00					
16. CEOAGE						0.01	0.03	−0.05 *	0.03 *	0.04 *	1.00				
17. CEOTENURE						−0.07 *	−0.19 *	−0.05 *	−0.13 *	0.04 *	0.11 *	1.00			
18. CEOOVER						−0.03 *	0.08 *	−0.02	0.07 *	−0.01	−0.08 *	−0.06 *	1.00		
19. BSIZE						0.06 *	0.00	−0.06 *	0.05 *	−0.02	0.05 *	0.10 *	−0.08 *	1.00	
20. BINDP						−0.06 *	−0.23 *	−0.05 *	−0.17 *	−0.05 *	0.05 *	0.14 *	−0.03 *	0.20 *	1.00

Notes: this table presents summary statistics and descriptive statistics between 2000 and 2018. * represents statistical significance at the 0.05 level or better.

4. Results

4.1. Baseline Analysis

To test H1, we estimate the following regression model:

$$CSR_{i,t} = \beta_0 + \beta_1 CEOPFP_{i,t} + \beta_n CONTROLS_{i,t} + \varepsilon_{i,t} \quad (1)$$

For firm i in year t , CSR is a firm's overall CSR performance, $CEOPFP$ is a level of CEO promotion focus relative to prevention focus; and $CONTROLS$ is a set of control variables. We also include year-fixed and industry-fixed effects (using two-digit SIC codes) to control for market-wide economic conditions and industry-wide practices.

Models 1 and 2 of Table 3 report the results of estimating Equation (1). Model 1 includes only the control variables. Results for the control variables are consistent with the prior literature. Model 2 includes the independent variable of $CEOPFP$ to test its main effect on CSR . The results show a significant and negative effect ($b = -0.110$, $p < 0.01$). Therefore, H1 is supported.

Table 3. CEO regulatory focus and CSR performance.

	Y = CSR	Y = CSR	Y = Internal CSR	Y = External CSR
Variables	Model 1	Model 2	Model 3	Model 4
CEOPFP (H1)		−0.110 *** (0.000)	0.018 (0.400)	−0.069 *** (0.000)
SIZE	0.062 *** (0.000)	0.061 *** (0.000)	0.012 *** (0.000)	0.018 *** (0.000)
FAGE	0.148 *** (0.001)	0.141 *** (0.001)	0.122 *** (0.006)	0.027 (0.166)
CASH	0.045 (0.739)	0.078 (0.565)	0.199 (0.154)	−0.105 ** (0.021)
SGROW	−0.432 *** (0.000)	−0.446 *** (0.000)	−0.074 (0.409)	−0.119 *** (0.007)
ROA	2.552 *** (0.000)	2.478 *** (0.000)	2.528 *** (0.000)	0.028 (0.772)
LEV	0.156	0.130	0.091	0.057

Table 3. Cont.

	Y = CSR	Y = CSR	Y = Internal CSR	Y = External CSR
Variables	Model 1	Model 2	Model 3	Model 4
	(0.161)	(0.245)	(0.408)	(0.184)
VOLAT	−0.073	−0.011	−0.394	−0.061
	(0.753)	(0.963)	(0.218)	(0.599)
RDINT	1.463 ***	1.511 ***	2.125 ***	−0.414 ***
	(0.000)	(0.000)	(0.000)	(0.000)
CAPINT	0.282	0.296	0.142	−0.278 ***
	(0.206)	(0.184)	(0.491)	(0.000)
CEOGENDER	−0.140	−0.146	−0.722 ***	0.128 ***
	(0.176)	(0.153)	(0.000)	(0.000)
CEOAGE	0.101	0.116	0.016	0.077
	(0.397)	(0.332)	(0.902)	(0.114)
CEOTENURE	−0.042	−0.032	−0.082 **	0.020
	(0.247)	(0.381)	(0.018)	(0.144)
CEOOVER	−0.313 ***	−0.308 ***	−0.080 **	−0.059 ***
	(0.000)	(0.000)	(0.018)	(0.000)
BSIZE	0.116 ***	0.116 ***	0.047 ***	0.003
	(0.000)	(0.000)	(0.000)	(0.486)
BINDP	0.391 ***	0.385 ***	0.352 ***	−0.003
	(0.000)	(0.000)	(0.000)	(0.909)
Year and industry fixed effects	Included	Included	Included	Included
Observations	8106	8106	8106	8106
R ²	0.375	0.377	0.217	0.420

Notes: *p*-values are in parentheses. * *p* < 0.10, ** *p* < 0.05, *** *p* < 0.01.

4.2. Different Impact of CEO's Promotion Focus Relative to Prevention Focus on Internal and External CSR

To isolate the specific channels through which CEO regulatory focus predominance impacts CSR, we additionally examine whether predominantly promotion-focused CEOs have equal or different impact on activities directed toward external or internal activities. External activities include corporate philanthropy and environmental protection, while internal CSR activities involve behaviors related to employee rights protection and development (Al-Shammari et al. 2019). Thus, we choose community relations and environmental policies to capture the externally oriented CSR of the firm and employee relations and diversity as the two most appropriate and relevant dimensions to capture the internally oriented CSR. Following Al-Shammari et al. (2019), we calculated *External CSR* as the sum of all scores of the strength ratings minus the sum of all concerns reported by KLD data concerning *Community* and *Environment* categories, and *Internal CSR* as the sum of all scores of the strength ratings minus the sum of all concerns reported by KLD data concerning employee relations and diversity categories.

We re-estimate Equation (1) by replacing CSR with *External CSR* or *Internal CSR* as the dependent variable and report the results in Models 3 and 4 of Table 3. We find that *CEOPFP* has a negative and significant impact on *External CSR* ($b = -0.069$, $p < 0.01$, Model 4) and an insignificant effect on *Internal CSR* ($b = 0.018$, $p > 0.1$, Model 3), suggesting that predominantly promotion-focused CEOs prefer externally oriented CSR rather than internally oriented CSR activities.

4.3. Endogeneity Analysis

We perform a battery of endogeneity and robustness analyses to address the potential endogeneity concerns resulting from omitted variables bias, selection bias, and reverse causality problems. These analyses confirm our results (see Supplementary Appendix).

4.4. Cross-Sectional Analysis

We next examine the role of corporate governance (i.e., CEO equity compensation and institutional ownership) as a moderating variable to shed light on the impact of CEO regulatory focus on CSR performance.

4.4.1. CEO Equity Compensation

CEO compensation structure is an important component of corporate governance and is used to incentivize executives to work toward a firm's particular goals and outcomes. It has been found to be an important compensation-related tool that helps corporate boards shape CEO behavior (Gamache et al. 2015). Agency theorists support the idea that rewarding stocks and stock options to CEOs can be an effective way to prevent CEOs from exhibiting shirking behavior, shortsightedness, and risk aversion (Jensen and Murphy 1990).

CEOs with higher equity compensation may have more at stake in terms of their personal reputation and public image. Thus, engaging in CSR is considered as a way for CEOs to demonstrate their commitment to social and environmental responsibilities, enhance firm reputation, and manage relationships with various stakeholders. CEOs will be compensated for their attempt to improve their firm's CSR performance as they recognize CSR can ultimately contribute to the firm's overall success. Moreover, while CSR initiatives are not always immediately financially rewarding, they can contribute to the firm's sustainable growth and long-term value, which aligns with the interest of CEO compensation incentives. In this case, CEOs with higher levels of compensation are inclined to invest more in CSR as a business activity, and we expect that the negative effect of CEOs' promotion focus predominance on CSR will be attenuated when CEO equity compensation is high.

Models 1 and 2 of Table 4 present the results for the moderating effect of CEO equity compensation. With the interaction term included in Model 2, we find a significantly positive interaction between *CEOPFP* and *CEOEBE* ($b = 0.220$, $p < 0.01$). As expected, this result suggests that the negative effect of a level of CEO promotion focus relative to prevention focus on CSR is weaker when CEOs have a higher proportion of equity compensation.

Table 4. Cross-sectional analysis.

Variables	Y = CSR				
	Model 1	Model 2	Model 3	Model 4	Model 5
CEOPFP	−0.099 *** (0.000)	−0.173 *** (0.000)	−0.110 *** (0.000)	−0.601 *** (0.000)	−0.776 *** (0.000)
CEOEQUNITY	0.427 *** (0.000)	0.460 *** (0.000)			0.532 *** (0.000)
INSOWN			0.463 *** (0.000)	0.495 *** (0.000)	0.643 *** (0.000)
CEOPFP * CEOEQUNITY		0.220 *** (0.005)			0.312 *** (0.000)
CEOPFP * INSOWN				0.633 *** (0.000)	0.735 *** (0.000)
SIZE	0.060 *** (0.000)	0.060 *** (0.000)	0.061 *** (0.000)	0.060 *** (0.000)	0.058 *** (0.000)
AGE	0.152 *** (0.007)	0.154 *** (0.007)	0.138 ** (0.015)	0.132 ** (0.019)	0.142 ** (0.012)
CASH	0.064 (0.680)	0.054 (0.724)	0.092 (0.548)	0.141 (0.358)	0.133 (0.387)
SGROW	−0.463 ***	−0.463 ***	−0.441 ***	−0.440 ***	−0.455 ***

Table 4. Cont.

Variables	Y = CSR				
	Model 1	Model 2	Model 3	Model 4	Model 5
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	2.456 ***	2.452 ***	2.447 ***	2.437 ***	2.375 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LEV	0.047	0.038	0.179	0.193	0.105
	(0.698)	(0.753)	(0.134)	(0.105)	(0.382)
VOLAT	0.048	0.047	−0.030	−0.105	−0.026
	(0.889)	(0.892)	(0.929)	(0.754)	(0.940)
RDINT	1.427 ***	1.432 ***	1.510 ***	1.458 ***	1.345 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAPINT	0.283	0.280	0.294	0.255	0.245
	(0.197)	(0.201)	(0.175)	(0.240)	(0.262)
CEOGENDER	−0.137	−0.134	−0.145	−0.144	−0.128
	(0.178)	(0.188)	(0.153)	(0.153)	(0.204)
CEOAGE	0.183	0.189	0.078	0.067	0.141
	(0.175)	(0.162)	(0.562)	(0.616)	(0.296)
CEOTENURE	−0.037	−0.036	−0.040	−0.044	−0.051
	(0.341)	(0.346)	(0.294)	(0.248)	(0.180)
CEOOVER	−0.296 ***	−0.298 ***	−0.305 ***	−0.299 ***	−0.284 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BSIZE	0.113 ***	0.112 ***	0.113 ***	0.113 ***	0.107 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BINDP	0.349 ***	0.344 ***	0.438 ***	0.437 ***	0.408 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year and industry fixed effects	Included	Included	Included	Included	Included
Observations	8064	8064	8106	8106	8064
R ²	0.379	0.380	0.378	0.380	0.385

Notes: *p*-values are in parentheses. * *p* < 0.10, ** *p* < 0.05, *** *p* < 0.01.

4.4.2. Institutional Ownership

Institutional investors have publicly stated their preference for firms that appear strong on CSR activities and have increasingly incorporated CSR into their corporate investments (Chen et al. 2020b). Research suggests that institutional investors play a role in pressuring firms to initiate and consequently adjust CSR reporting to better reflect the preferences of their institutional investors (Christensen et al. 2021). There is evidence that institutional ownership has a positive impact on CSR (Dyck et al. 2019) by mitigating concerns about overinvestment and agency problems through promoting the optimal allocation of firm resources and monitoring managerial actions in response to strategic decisions (Buchanan et al. 2018). Several studies suggest that by holding stable stakes in a firm, institutional investors specialize in monitoring activities, play a crucial role in corporate governance, and provide effective external control regarding the information transparency of CSR reporting (Yu and Zheng 2020). In line with this stream of work, we expect that monitoring by institutional investors can enhance CSR by reducing value-destroying activities related to CEO regulatory focus. Thus, we expect that the effect of CEOs' promotion focus predominance on CSR will be weaker when institutional ownership is high.

Models 3 and 4 of Table 4 present the results of the moderating effect of institutional ownership. We find a positive and significant interaction between *CEOPFP* and *INSOWN* ($b = 0.633$, $p < 0.01$, Model 4), suggesting that as institutional ownership increases, the negative effect of a level of CEO promotion focus relative to prevention focus on CSR will be mitigated. Model 5 of Table 4 is the full model when including all moderators. We find that the results are largely the same.

4.5. Mediation Analysis

To test H2 ($X \rightarrow M \rightarrow Y$), we conduct a mediation analysis using the following two-model set (PROCESS Model 4), suggested by Hayes (2022):²

$$FP_{i,t} = a_1 + b_1 CEOPFP_{i,t} + \gamma_n CONTROLS_{i,t} + \varepsilon_{1,i,t} \quad (2)$$

$$CSR_{i,t} = a_2 + b_2 CEOPFP_{i,t} + \beta_n CONTROLS_{i,t} + \varepsilon_{2,i,t} \quad (3)$$

$$FP_{i,t} = a_3 + b_3 CEOPFP_{i,t} + \lambda_1 CSR_{i,t-1} + \gamma_n CONTROLS_{i,t} + \varepsilon_{3,i,t} \quad (4)$$

Figure 1 indicates the intuition behind the path analysis to test H2, following Baron and Kenny (1986). *Path c* corresponds to the total effect of the independent variable ($X = CEOPFP$) on the dependent variable ($Y = FP$), while *Path a* corresponds to the effect of X on the mediator variable ($M = CSR$), and *Path b* corresponds to the effect of M on Y . In Equation (2), the total effect of $CEOPFP$ on FP is b_1 , which decomposes into the direct effect of $CEOPFP$ (b_3) and the mediation effect ($b_2 \times \lambda_1$), or the product of Paths a and b shown in Figure 1. Because the total effect is also obtained as $b_1 = b_3 + b_2 \times \lambda_1$, only Equations (3) and (4) need to be estimated.

Panel A, Table 5 reports the mediation results of estimating Equations (2) to (4). According to Baron and Kenny (1986), a variable operates as a mediator when the following three criteria are met. The first condition proposes that X is significantly related to M (*Path a*). We find a negative effect of $CEOPFP$ on CSR ($b = -0.130$, $p < 0.01$, Model 2). The second condition suggests that M is significantly related to Y (*Path b*). We find that the effect of CSR on FP is positively supported ($b = 0.007$, $p < 0.05$, Model 3). The third condition proposes that when the impacts of Path a and b are considered, the impact of X on Y should weaken or become insignificant when including the mediator. When CSR is included, we find that the effect of $CEOPFP$ on FP decreases; while it remains negative, it is significant ($b = -0.011$, $p < 0.05$ in Model 3 is smaller in magnitude in comparing to $b = -0.017$, $p < 0.01$ in Model 1). Our results meet all three conditions, suggesting that CSR partially mediates the negative relationship between $CEOPFP$ and FP , providing preliminary support for H2. Our results suggest that firms led by predominantly promotion-focused CEOs experience a decrease in CSR performance, which, in turn, leads to lower FP .

Table 5. Mediation analysis. Panel (A): Direct and indirect effect of regulatory focus on FP. Panel (B): Bootstrapped mediation analysis.

Panel (A)			
Variables	Direct Effect	Mediation Effect	
	Y = FP	M = CSR	Y = FP
	Model 1	Model 2	Model 3
CEOPFP (H2)	−0.017 *** (0.000)	−0.130 *** (0.000)	−0.011 ** (0.048)
CSR			0.007 ** (0.021)
SIZE	−0.000 (0.978)	0.064 *** (0.000)	−0.001 * (0.053)
AGE	−0.006 (0.677)	0.135 ** (0.039)	0.014 (0.325)
CASH	0.733 *** (0.000)	−0.176 (0.334)	0.681 *** (0.000)
SGROW	0.051 * (0.065)	−0.466 *** (0.000)	0.037 (0.101)
ROA	3.133 *** (0.000)	2.533 *** (0.000)	2.855 *** (0.000)

Table 5. Cont.

Panel (A)			
Variables	Direct Effect	Mediation Effect	
	Y = FP	M = CSR	Y = FP
	Model 1	Model 2	Model 3
LEV	−0.138 *** (0.000)	0.131 (0.341)	−0.080 *** (0.008)
VOLAT	0.440 *** (0.001)	0.009 (0.981)	0.341 *** (0.000)
RDINT	1.467 *** (0.000)	2.115 *** (0.000)	1.506 *** (0.000)
CAPINT	0.236 *** (0.002)	0.485 * (0.090)	0.117 * (0.064)
CEOGENDER	0.004 (0.856)	−0.103 (0.373)	0.006 (0.818)
CEOAGE	−0.068 ** (0.022)	0.257 * (0.096)	−0.064 * (0.061)
CEOTENURE	0.039 *** (0.000)	−0.074 * (0.096)	0.039 *** (0.000)
CEOOVER	0.133 *** (0.000)	−0.353 *** (0.000)	0.122 *** (0.000)
BSIZE	0.003 (0.147)	0.094 *** (0.000)	0.005 * (0.056)
BINDP	0.032 ** (0.034)	0.343 *** (0.000)	0.017 (0.342)
Year and industry fixed effects	Included	Included	Included
Observations	7555	6097	6097
R ²	0.640	0.398	0.564
Panel (B)			
Y = FP			
Indirect Effect of X on Y	Observed Coefficient	Bootstrap Standard Errors (SE)	Bootstrap 95% CI (BC)
X → M → Y	−0.002 ***	0.001	(−0.003, −0.001)

Notes: *p*-values are in parentheses. * *p* < 0.10, ** *p* < 0.05, and *** *p* < 0.01. Bootstrap sample size = 5000. The figures presented in the table using bootstrap command in Stata16. SE = standard errors, CI = confidence interval (lower and upper 95% reported), BC = bias corrected. X = CEOPFP, M = CSR, Y = FP. Observations = 6097 in Models 2 and 3 is the application of the lagged model specified in Equation (4).

To further validate H2, we conduct a mediation analysis using a bootstrapping approach recommended by Hayes (2022) and Preacher et al. (2007). Bootstrapping provides an empirical approximation of sampling distributions of indirect effects to provide the 95% confidence intervals (CIs) of estimates. If zero does not fall within the confidence interval, once can conclude that an indirect effect is different from zero (Preacher et al. 2007). This bootstrap command is generated by Stata 16 software to obtain both a bootstrapped 95% CI and the standard errors (SE) estimate for the product of coefficients (see Gould 1993). Panel B of Table 5 reports the bootstrapped results for the mediation effect, using the 5000 bootstrapped samples.³ We find a negative and significant indirect effect of *CEOPFP* on *FP* via *CSR* ($b = -0.002$; $SE = 0.001$, $p < 0.01$; 95% CI = $[-0.003 \text{ to } -0.001]$), which supports our prior assertion. Thus, H2 is supported.

5. Discussion

Given the strategic importance of CSR for contemporary corporations, researchers have increasingly investigated CSR and aimed to answer questions relating to the *antecedents* and *consequences* of CSR over the past four decades (e.g., Aguinis and Glavas 2019; Freeman 1984). Using a large sample of publicly listed US firms spanning from 2000 to 2018, our study aims to answer two unique related questions on the overarching relationship

between a CEO's regulatory focus, the firm's CSR, and its FP. We first propose that CEO promotion focus predominance is an important reference point for a firm's CSR performance. Second, we theorize that CSR serves as a mediator in the relationship between CEO promotion focus predominance and FP.

Consistent with our theorizing, we find that firms led by predominantly promotion-focused CEOs are associated with lower CSR performance. This negative association is weaker in firms with a higher level of CEO equity compensation and higher institutional ownership. Furthermore, the negative impact of CEO promotion focus predominance on FP is partially mediated by firms engaging more in CSR. These findings provide important theoretical and practical implications.

5.1. Theoretical Implications

Theoretically, our study provides several contributions to the literature on the impact of CEO characteristics on corporate decisions. First, we contribute a nuanced understanding of how CEOs inject their motivational attributes (i.e., promotion focus vs. prevention focus) into their strategic decisions related to the engagement in CSR. While the extant literature on the role of such CEO psychological traits has been largely emphasized in the context of corporate risk-taking, such as pursuing acquisitions and innovations (Gamache et al. 2015; Kashmiri et al. 2019), the impact of these traits on CSR has remained largely unexplored. We therefore extend this literature by investigating the influence of CEO psychological traits in general and regulatory focus (i.e., a CEO's promotion focus relative to prevention focus) in particular on CSR, an area that has received limited attention from both upper echelons theory and regulation focus theory researchers. Our results answer the call for more research on the *"cognitive and motivational conditions that lead stakeholders to evaluate firms' social activities differently"* (Wang et al. 2016, p. 542).

Second, we contribute to the corporate governance literature by shedding light on how corporate governance factors—as proxied by CEO equity compensation and institutional ownership—interact with CEO psychological characteristics in shaping corporate strategy. We find that the negative impact of a level of CEO promotion focus relative to CEO prevention focus on CSR is attenuated in firms with high CEO equity compensation and high institutional ownership. Our results suggest that corporate governance (external or internal) is an effective lever that can be employed by the corporate board to monitor and control the positive or negative effects of CEO regulatory focus on corporate strategy.

Third, we advance strategic leadership research by providing a more detailed explanation of how FP is influenced by CEO regulatory focus through better CSR activities. We theorize and find empirical support for the view that CSR mediates the relationship between CEO regulatory focus and FP, which has been omitted heretofore in the literature. Our results also shed light on whether CSR affects the CEO regulatory focus–FP connection, which provides a potential explanation for the empirically inconsistent evidence in prior work.

5.2. Practical Implications

Our findings provide important implications for different stakeholder groups, including executives, directors, and investors. For instance, executives may benefit by understanding the motivational tendencies of CEOs to take advantages of the positive aspects of their regulatory focus and avoiding its negative consequences in shaping strategic decisions.⁴ For the board of directors, understanding how CEO motivational attributes impact a preference towards or against a particular course of action (e.g., improving CSR performance) is very important for their CEO hiring decisions. Our findings can encourage directors to consider forming a balanced top management team by counterbalancing their incentive compensation arrangements. Investors may benefit from using a CEO regulatory focus as an effective signal to shape their investment decisions in situations when the CEO is newly hired and there is considerable uncertainty about the CEO's future strategic decisions.

5.3. Limitations and Future Research

Like all studies, our findings are subject to limitations that may be addressed in future research. First, the implications of our study may not be generalizable, as there are different jurisdiction systems across the world. We encourage future research to explore firms outside the US. In addition, in this study, CEO regulatory focus is assessed based on their psychological orientation toward regulating behavior through promotion focus and prevention focus words extracted from CEO letters to shareholders, a measurement commonly used in management studies (e.g., Gamache et al. 2015, 2020). We acknowledge the challenge of directly measuring the regulatory foci of CEOs due to data availability constraints and encourage future research to explore a more direct measure approach. Future research could also use other measures of regulatory foci, such as survey measures and experimental methods. Furthermore, we encourage future research to explore other factors that might moderate the effect of CEO regulatory focus on CSR. Such factors may include prior firm performance, environmental turbulence, and corporate culture.

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Notes

- ¹ While traditional survey or experimental studies often rely on financial metrics measured using scale points (e.g., Lockwood et al. 2002), we followed prior empirical studies (e.g., Chung and Low 2022; Gamache et al. 2015, 2020) and adopt a broader perspective by using the content analysis of CEOs' annual letters to shareholders to measure CEO regulatory focus. Indeed, content analysis has endorsed by experts as "accurately represents the focal concept" (Short et al. 2010, p. 320). Eggers and Kaplan (2009) also suggest that letters to shareholders has been considered as an ideal content to analyze due to their consistent, comparable, and annual form of communication that are reflective of the CEO's style and word choices. This approach is particularly suitable for longitudinal research. There is compelling evidence that the CEO is the primary author of the letter, and highly involved in drafting and editing it (Eggers and Kaplan 2009; Gamache et al. 2020). Following this rationale, studies have used letters to shareholders as an example for optimal content analyses (e.g., Eggers and Kaplan 2009; Gamache et al. 2020; Short et al. 2010). We then used Linguistic Inquiry and Word Count (LIWC) software, an approach frequently used for measuring psychological processes, to detect the content.
- ² PROCESS Macro is widely used in social science and management studies for estimating the meditation hypothesis. One advantage of using the PRCOESS Macro over simultaneous equations models and simple regression analysis is its robustness in addressing potential endogeneity issues between the dependent, independent, and mediator variables (Hayes 2022).
- ³ According to Edwards and Lambert (2007), "When constructing confidence intervals, a minimum of 1000 bootstrap samples should be used to accurately locate the upper and lower bounds of the 95% confidence interval" (pp. 11–12). In our study, we used a larger bootstrap sample size (i.e., 5000), leading to more accurate estimates of parameters or statistics (Preacher et al. 2007).
- ⁴ CEOs who realize their promotion-focused tendencies may benefit by surrounding themselves with prevention-focused management team members to improve CSR. Similarly, CEOs who realize their prevention-focused tendencies may benefit by having promotion-focused management team members engage in other important activities such as acquisitions and innovations that may be pertinent to corporate strategy.

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Article

Financial Risk, Debt, and Efficiency in Indonesia's Construction Industry: A Comparative Study of SOEs and Private Companies

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Abstract: This study aims to evaluate the financial risk, debt, and efficiency of state-owned enterprises (SOEs) in Indonesia's construction industry and compare these aspects with those of private companies through financial ratio analysis and efficiency analysis approaches. Four SOEs from the construction sector were evaluated and compared to five private companies with financial data ranging from 2015 to 2022. Financial ratio analysis was applied to assess debt and financial risk, while efficiency analysis utilized data envelopment analysis (DEA) and paired *t*-tests to validate differences between the two groups of companies. This study reveals that the financial ratio performance of state-owned companies is relatively poor, with low profitability, critical liquidity, and a high debt ratio. Debt, as a source of capital in financing construction projects, causes companies to face a greater debt risk. This study also validates that SOEs have lower efficiency compared to private companies. In response to current challenges, SOEs should prioritize enhancing liquidity through faster receivable collections, debt restructuring, capital infusions, and divestment, reducing non-essential investments, focusing on asset recycling, and improving project efficiency.

Keywords: construction industry; debt; efficiency; financial performance; state-owned enterprises (SOEs)

1. Introduction

As a developing country, Indonesia is accelerating infrastructure development to boost the national economy. This infrastructure growth is supported by the state-owned and private-owned construction sectors. The Indonesian government, through its substantial infrastructure projects, has directed significant funding toward state-owned construction enterprises (SOEs), providing them with a competitive advantage over private construction companies. Typically, the government has proactively addressed challenges related to SOEs' financial positions, ensuring efficiency, stabilizing employment structures, and maintaining company debt at manageable, low-risk levels (Anggraini and Febrianty 2022). But recently, SOEs in Indonesia have experienced financial difficulties. The large number of government projects has increased the operational burden of SOEs, resulting in increased debt levels.

In their operations, SOEs face challenges that negatively impact their financial performance, such as negative net income growth, high debt-to-equity ratios, and suboptimal financial ratios. This study aims to evaluate the financial condition of SOEs in Indonesia and compare them with private companies using the financial ratio analysis approach as conducted by Vibhakar et al. (2023), as well as efficiency analysis as researched by Jung and Kim (2023). Poor financial health is a crucial aspect affecting these companies' sustainability and their role as a critical foundation in Indonesia's infrastructure development.

SOEs consist of four significant issuers, namely PT Adhi Karya (Persero) Tbk (ADHI), PT Housing Development (Persero) Tbk (PTPP), PT Waskita Karya (Persero) Tbk (WSKT), and PT Wijaya Karya (Persero) Tbk (WIKA). The deterioration in the condition of SOEs began with the realization of investment and income, which tended to decline significantly.

The realization of SOEs' investment has declined due to the transfer of investment assets, coupled with the condition of SOEs' net income, which experienced a drastic decline since 2018 and grew slowly from 2020 to 2022 (Figure 1). The decline in SOEs' net income has also been exacerbated by the demands of government projects, which have increased the company's operating expenses (Nur and Woestho 2022).

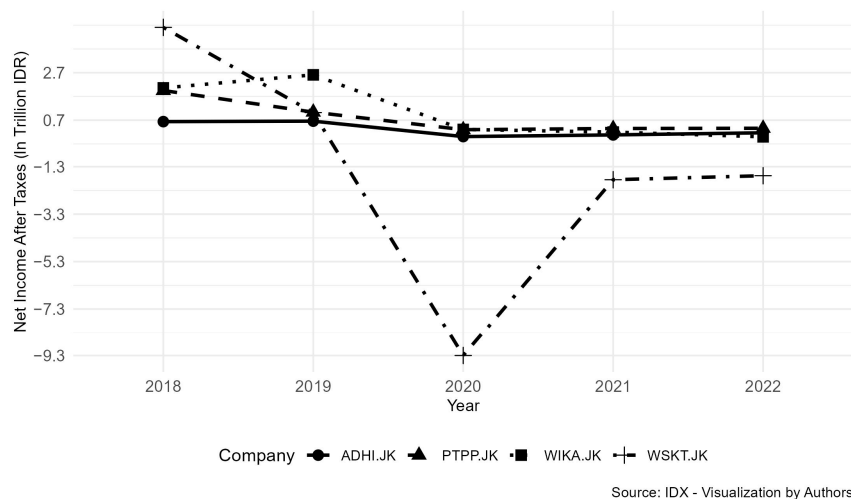


Figure 1. Net income of construction SOEs 2018–2022.

The next obstacle is the problem of debt settlement. The high level of debt in SOEs has caused the debt-to-equity ratio (DER) to increase sharply. Compared to other construction companies, SOEs have the highest DER level. Negative short-term sentiment and SOE debt restructuring plans are the main drivers of the problem (BEI 2023). Furthermore, regarding return on assets (ROA), SOEs show lower performance than their competitors. This illustrates that the returns generated have not been effective in achieving good profitability.

In addition, the above indicates that a high level of short-term debt is the cause of the decline in the company's financial performance. Jayiddin et al. (2017) stated that the short-term debt ratio has a significant negative relationship with the performance of construction companies in Malaysia. As is known, construction companies in Malaysia in 2010–2014 had a high debt ratio, making them more vulnerable to bankruptcy risk due to fluctuations in interest rates. In addition, Hamid et al. (2015) also stated that the debt ratio has a significant negative relationship with company profitability. Companies that use more debt cause erosion of company profits (Baharuddin et al. 2011). Especially at this time, most construction companies are too dependent on bank debt, which contains greater risk. Excessive dependence on the banking system can increase the instability of the entire financial system (Wang 2023).

The management of corporate debt must be adjusted to the nominal debt and the income generated or the assets owned by the company, ensuring that the company can repay the debt and interest at maturity. SOEs, in the face of debt pressure, often restructure debt (Putri and Putri 2024). It is essential for management to always maintain an optimal level of debt and prevent financial distress (Adhi and Alfarisi 2019).

The impact of the COVID-19 pandemic, coupled with massive government projects, has caused SOEs to be increasingly burdened in financing their operations. Competition with private companies is also a significant challenge for SOEs. The market share of government-owned construction companies has decreased. Increasing price competition with competing companies and a lack of technical experience in some sectors have contributed to the erosion of SOEs' market share.

The condition of SOEs that are experiencing fundamental problems must be corrected immediately, given the critical role of SOEs in achieving the government's vision for infrastructure development to improve real sector efficiency, provide transportation

facilities, support economic growth, and achieve equitable national development (Asian Development Bank 2020; Utomo et al. 2022). In addition, competition with other companies now competing in digitalization and technological innovation also puts pressure on SOEs. Therefore, improving operational efficiency and strengthening technical capacity are crucial for the sustainability and competitiveness of SOEs in the construction sector.

The financial performance of SOEs in Indonesia has exhibited a declining trend over recent periods, necessitating an evaluation of the principal causes behind this downturn. This study aims to assess whether private companies in the same sector are experiencing similar issues, and to determine whether the observed trends are attributable to broader weaknesses within the Indonesian construction industry or to specific performance deficiencies in SOEs compared to private companies. Utilizing financial ratio analysis, based on the Peterson (2013) method, to assess debt and financial risk, along with efficiency analysis conducted through data envelopment analysis (DEA), this research will compare the financial performances of SOEs and private companies. Additionally, a paired *t*-test will be conducted to confirm any differences in efficiency between the two groups, utilizing publicly available financial data from the period of 2015 to 2022. The outcomes of this evaluation are expected to serve as a preliminary step in developing improvement strategies for relevant stakeholders.

The subsequent sections of this paper will explore the literature review, data sources, and methods used in this study. This is followed by an analysis of the research findings and a discussion on their implications. The paper concludes with a summary of the main findings in Section 6.

2. Literature Review

Financial ratio analysis is used to evaluate a company's position in the industry and other companies to assess the company's performance over some time. This analysis is also considered helpful for measuring the performance of managers and departments and projecting future performance trends of the company for relevant stakeholders (El-Kholy and Akal 2021). Studies on financial ratio analysis, such as those conducted by Vibhakar et al. (2023), analyzed the financial ratios of 100 construction companies in India over ten years (2008–2017) using factor analysis to classify financial ratios as important sub-factors for construction companies. Five critical financial ratio factors were identified: investor returns, business efficiency, operations management, activity efficiency and risk coverage, and asset management. In a global context, similar research is often conducted, such as in the study of Emin et al. (2007) and Chong et al. (2013).

In Indonesia, research on financial ratio analysis of construction companies was conducted by Daryanto et al. (2021) by measuring financial ratios before and during the COVID-19 pandemic using the Altman Z-Score approach. The results showed that PT PP had lower liquidity, solvency, profitability, and activity ratios during the pandemic. Research by Afriza and Daryanto (2019) examined the financial ratios of construction SOEs in Indonesia based on the reference of the Decree of the Minister of SOEs Number KEP-100/MBU/2002 and found that construction SOEs in Indonesia were in a stable and good financial condition in 2011–2015. Meanwhile, research by Muhammad and Rahadi (2023) analyzed financial ratios in construction-sector SOEs and concluded that all SOEs experienced a decline in financial performance during the 2019–2021 period.

This study uses a different analytical point of view by utilizing Peterson's financial ratio approach to measure construction companies' good and bad financial ratios. Peterson's (2013) financial ratios focus on several unique aspects explicitly designed for the construction industry, which differ significantly from typical accounting practices due to the unique nature of construction projects. Accounting practices in the construction industry must adapt to the specific requirements of long-term contracts, where revenue recognition is often linked to completion percentage. This is particularly important as it affects the financial reporting and health of the construction company throughout the project (Zadorozhnyi and Ometsinska 2020).

Managing construction company finances requires a project-based approach, considering each project's unique costs and schedules. This involves detailed cost tracking and forecasting, critical to maintaining profitability and managing cash flow effectively (Sowmya and Malisetty 2023). The construction industry requires a specialized approach to cost accounting to handle the direct and indirect costs associated with construction projects. This is difficult because costs must be allocated to specific projects and can vary significantly between projects (Bozgulova and Adambekova 2023). These aspects underscore the need for specialized accounting and financial management techniques in construction, comprehensively discussed in Peterson (2013), to meet the sector's unique challenges.

In terms of efficiency analysis, this study follows Jung and Kim (2023), who used DEA to analyze the efficiency of 520 construction firms from 2017 to 2021. Their findings showed significant scale-related inefficiencies, suggesting the need for these firms to reduce production factors. The concrete construction sector was much more efficient than other sectors. The COVID-19 pandemic contributed to a temporary drop in efficiency in 2020, followed by a partial recovery in 2021. The study also reported a notable decline in operating profit efficiency in 2021. The study emphasizes that specialized construction companies must improve efficiency by managing input factors more effectively, especially in light of rising raw material prices.

In the Indonesian context, recent research by Sukandar et al. (2018) on the efficiency of the construction industry in Indonesia also used DEA for the period of 2010–2016. The results showed that state-owned companies were more efficient than private companies. This is due to the large number and value of projects from the government in the infrastructure sector. This study shows that companies with many projects, significant revenues (sales), and low costs are more efficient. Therefore, private firms should receive more projects and larger project values, including from government projects.

In this study, financial ratio analysis and efficiency analysis were carried out on state-owned companies in the construction sector and private companies as a relative comparison; so this study is comparative to private companies in the research period. In addition, this study is also comparative with previous studies that used different research periods. In analyzing efficiency using DEA, this study continued with a different test between the efficiency of SOEs and the private sector using a paired *t*-test for statistically more robust validation.

3. Data Sources and Methods

3.1. Data and Research Variables

This study uses two main variables: financial ratio variables for financial ratio analysis and input–output variables for efficiency analysis (Appendix A). There are 68 observations in the financial ratio analysis from 2015 to 2022, which are obtained from the financial statements of each construction company. The population of this study is construction companies in Indonesia, with a sample consisting of nine construction companies with the largest capitalization, which includes four state-owned construction companies and five private construction companies (Appendix B). The data are taken from the annual financial statements published by each company.

3.2. Financial Ratio Analysis

The financial ratio analysis in this study uses the Peterson (2013) approach. Peterson's approach was chosen because it provides comprehensive coverage for analyzing the company's financial performance through various relevant financial ratios. Peterson's financial ratios in this study include the following:

- a. Liquidity ratio: Measures a company's ability to meet its short-term obligations. This ratio is essential to assess the health of the company's liquidity and ensure it has enough current assets to cover its current liabilities. The liquidity ratio proxies in this study are the quick and current ratios;

- b. Profitability ratios: Assess a company's ability to generate profits relative to its sales, assets, and equity. This ratio measures operational efficiency and the company's ability to provide profits to shareholders. The profitability ratio proxies in this study are gross profit margin (GPM), asset turnover (ATPM), return on assets, and return on equity (ROE);
- c. Debt or leverage ratio: This ratio measures a company's capital structure, specifically how much it relies on debt to fund its assets. Understanding this ratio is essential to understanding financial risk and the company's ability to manage its long-term obligations. The debt ratio proxies in this study are current-liabilities-to-net-worth ratio (CLNWR), debt-to-equity ratio (DER), and accounts-payable-to-receivables ratio (APRR).

This analysis uses benchmark financial ratios for the construction industry as a reference (Appendix C).

3.3. Efficiency Analysis

This study uses the data envelopment analysis (DEA) approach and paired *t*-tests for efficiency analysis. DEA is a non-parametric linear programming-based method used to calculate the efficiency of a decision-making unit (DMU) by modeling the complex relationship between inputs and outputs. DEA constructs efficient bounds on the data and calculates the efficiency of each DMU relative to those bounds. DEA efficiency indicates the extent to which a DMU is ahead of its peers and represents its ability to convert many inputs into many outputs (Saini et al. 2023).

DEA uses two main models for efficiency analysis (Saini et al. 2023):

- a. CCR (Charnes–Cooper–Rhodes) Model: The basic DEA model that assumes Constant Return to Scale (CRS) (Charnes et al. 1978). This model is suitable when the scale of DMU operations does not affect efficiency, i.e., proportional input changes will result in proportional output changes. Assuming CRS, the CCR model calculates overall technical efficiency;
- b. BCC (Banker–Charnes–Cooper) Model: A model that assumes Variable Return to Scale (VRS) (Banker et al. 1984). This model is used when the scale of DMU operations affects efficiency, i.e., proportional input changes do not necessarily result in proportional output changes. The BCC model makes it possible to measure pure technical efficiency by considering different scales of operation.

This study uses the CCR model with CRS assumptions and an input-oriented approach. This model was chosen for several reasons. First, the CCR model provides a more straightforward approach to efficiency analysis, assuming that the scale of DMU operations does not affect efficiency. This aligns with the research objective of assessing the overall technical efficiency between SOEs and the private sector without considering variations in the scale of operations. Finally, the ease of implementation of the CCR model makes it easier to implement and understand, especially in the context of research involving many input and output variables, allowing for a more direct calculation of efficiency.

The input-oriented CCR model is formulated as follows:

$$\text{Min } \theta$$

With the following constraints:

$$\begin{aligned} \sum_{j=1}^n \lambda_j x_{ij} &\leq \theta x_{io} \forall i \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq y_{ro} \forall r \\ \lambda_j &\geq 0 \forall j \end{aligned}$$

where the variables represent the following:

- θ is the efficiency score sought;
- x_{ij} is the sum of the i -th input of DMU j ;
- y_{rj} is the sum of the r -th output of DMU j ;
- x_{io} and y_{ro} is the sum of the i -th input and r -th output of the evaluated DMU;
- λ_j is a decision variable that shows the relative weight of DMU j .

Using this formulation, DEA compares the DMU under evaluation with a linear combination of other DMUs to determine its efficiency at converting inputs into outputs. If $\theta = 1$, the DMU is considered efficient. If $\theta < 1$, the DMU is considered inefficient.

Seo and Choi (2011) used DEA to analyze the efficiency of construction companies in Korea, with inputs in the form of total assets, selling and administrative expenses, and total debt, as well as outputs in the form of total revenue and operating profit. Then, Sukandar et al. (2018) used inputs in the form of construction costs per m² of building, capital, total operating costs, and debt and outputs in the form of sales (revenue), EBIT, and net profit in analyzing the efficiency of construction companies in Indonesia. Debt is an input for construction companies because the total capital structure of each construction company can generally be financed through equity capital or debt capital, each of which has its advantages and disadvantages. Debt capital can be considered the cheapest source of funding, but on the other hand, debt capital that is too excessive can significantly increase the financial risk of the company (Mohammed 2007). This study does not use debt as an input. However, debt can be reflected in the company's total assets, where the construction company's assets are financed by debt (Utamaningsih and Muharis 2020).

To validate the real difference in efficiency results between state-owned and private construction companies, this study utilized a two-sample paired t -test. This statistical method is particularly parsimonious and robust for our analysis. The paired t -test is suitable because it primarily assesses the difference in means between two related groups, relying on the difference within pairs rather than the overall data distribution. This characteristic makes it especially applicable when the sample size is small and the assumption of normality may be violated (Manfei et al. 2017).

The steps of the two-sample paired t -test are as follows:

1. Hypothesis:
 - Null Hypothesis (H0): There is no difference in average efficiency between state-owned and private construction companies;
 - Alternative Hypothesis (H1): There is a difference in average efficiency between state-owned and private construction companies;

2. The t -test formula:

$$t = \frac{\bar{d}}{s_d / \sqrt{n}}$$

where the variables represent the following:

- $\bar{d}$ is the average difference of the sample pairs;
- s_d is the standard deviation of the difference of the sample pairs;
- n is the number of sample pairs;

3. Test Decision:

- If the calculated t value exceeds the critical t value, reject H0;
- If the calculated t value is less than or equal to the critical t value, fail to reject H0.

Using a two-sample paired t -test, this study was able to determine whether there is a significant difference in efficiency between state-owned and private construction companies.

4. Research Results

In this section, results of the financial ratio analysis based on Peterson's approach are presented, including the liquidity ratios, profitability ratios, and leverage ratios. Additionally, efficiency measure outcomes using the DEA approach are discussed, along with the validation of efficiency differences between SOEs and private companies using the t -test.

All analyses are dynamically presented across the entire study period from 2015 to 2022, while the averages are displayed in tabular form in the Appendix D, Appendix E, and Appendix F.

4.1. Liquidity Ratio

Table A4 (Appendix D) shows that all SOEs have quick ratio and current ratio values below the industry average. Compared to private companies, most SOEs have lower quick ratio values. Meanwhile, the current ratio value of SOE companies is similar to that of private companies, except for JKON.

Based on Figure 2, the majority of state-owned companies from 2015 to 2021 have a quick ratio and current ratio trend that tends to be negative, where the lowest quick ratio and current ratio values occur in 2020–2021. Meanwhile, in 2020–2021, the quick and current ratios in most private companies have shown a positive trend. In addition, the figure also shows that the current ratio of SOEs tends to be more stable than the private sector.

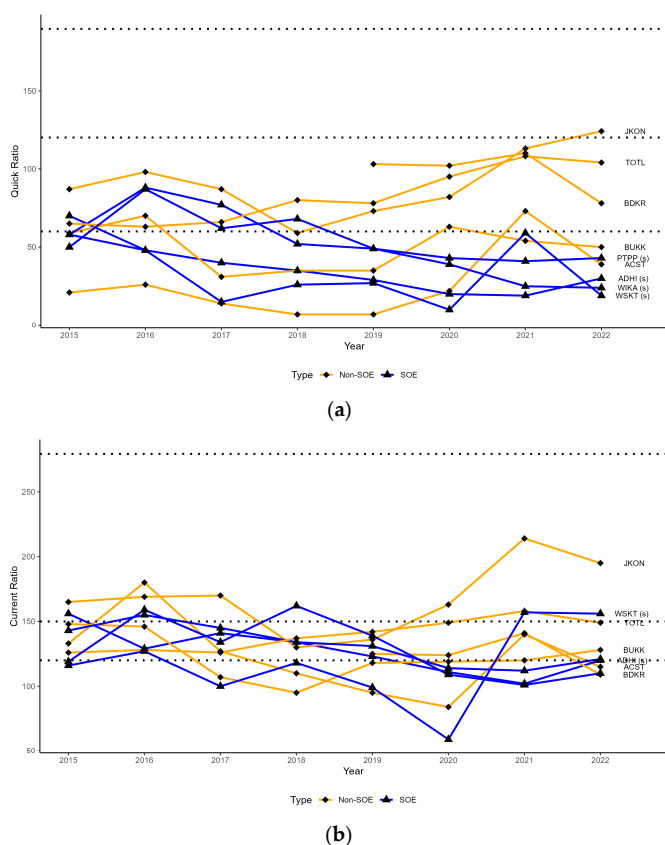


Figure 2. (a) Quick ratio and (b) current ratio of state-owned and private construction companies. The maximum value of the Peterson benchmark (top dot line), the average value of the Peterson benchmark (middle dot line), and the minimum value of the Peterson benchmark (bottom dot line).

4.2. Profitability Ratio

Table A5 (Appendix E) shows that almost all SOEs have GPM and ROA values below the industry average. The majority of the sample of SOE construction companies have ATPM values above the industry average. Private companies' GPM, ATPM, ROA, and ROE values (except ACST) are higher than those of state-owned companies.

Based on Figure 3, all state-owned and private companies experienced a decline in ROA and ROE in 2020. However, private companies experienced a more significant decline in ROA than SOEs. The state-owned company WSKT and the private company ACST experienced the most significant decline in ROE.

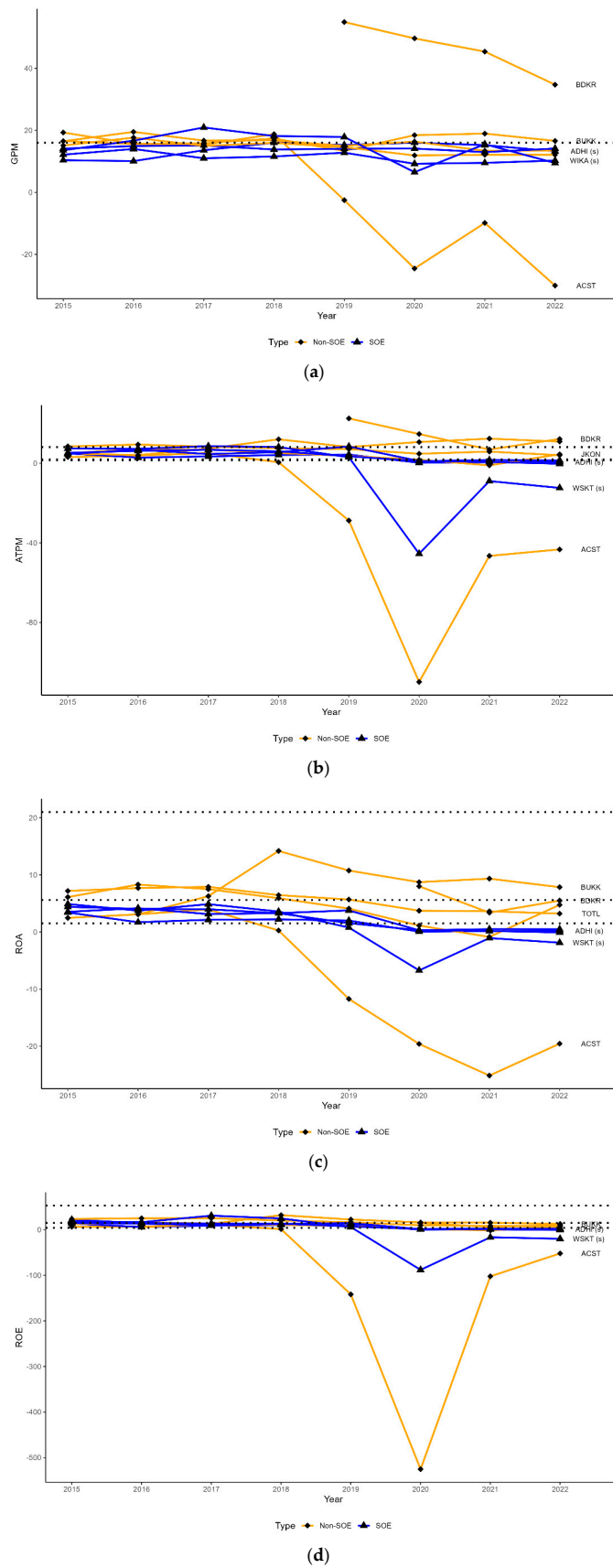


Figure 3. (a) Trend of GPM; (b) ATPM; (c) ROA; and (d) ROE of state-owned and private construction companies. The maximum value of the Peterson benchmark (top dot line), the average value of the Peterson benchmark (middle dot line), and the minimum value of the Peterson benchmark (bottom dot line).

4.3. Leverage Ratio

Table A6 (Appendix F) shows that SOEs have CLNWR values above the industry average and APRR values below the industry average. Compared to the private sector, SOEs tend to have higher CLWR, DER, and APRR values than most private companies.

Based on Figure 4, from 2015 to 2021, state-owned companies tended to experience increased CLNWR values. On the other hand, all private companies experienced a decrease in CLNWR values from 2020 to 2021, and some continued to decline until 2022. The DER value of private companies (except ACST) tends to be more stable than SOEs. SOEs tended to experience an increase in DER value, with the highest DER value occurring for WSKT, especially in 2019. Meanwhile, the DER value of private companies tended to decrease from 2020 to 2021.

When looking at the four state-owned companies, PTPP and WIKA are mostly superior in all financial ratios during 2015–2022. WSKT excels in GPM, but with high GPM; WSKT cannot obtain high ATPM, ROA, and ROE. WSKT's DER level is the highest among other companies. This indicates that WSKT's debt burden erodes the GPM obtained.

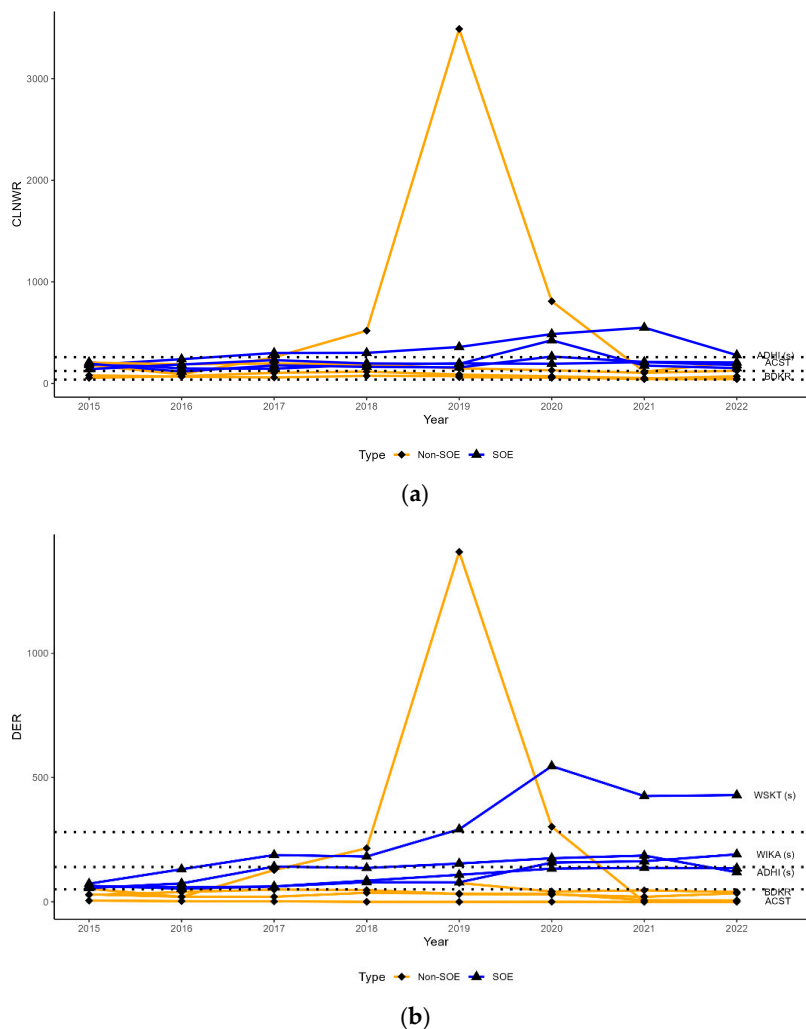


Figure 4. Cont.

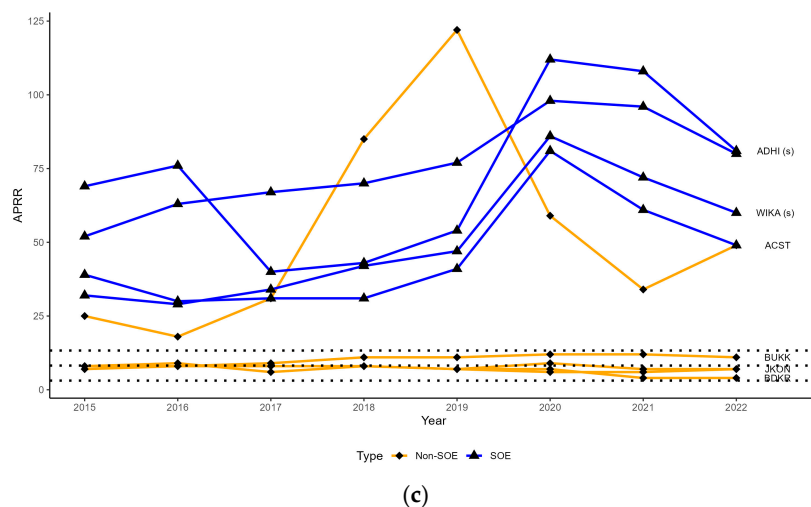


Figure 4. (a) Trend of CLNWR; (b) DER; and (c) APRR of state-owned and private construction companies. The maximum value of the Peterson benchmark (top dot line), the average value of the Peterson benchmark (middle dot line), and the minimum value of the Peterson benchmark (bottom dot line).

4.4. Efficiency Analysis with DEA

The input value of SOEs, which consists of revenue cost, operating expenses, and total assets, has a higher average than the input of private companies, likewise with the output in the form of revenue generated. Input distribution data with high standard deviation and max–min values show that construction companies in Indonesia exhibit a relatively high level of diversity (Table 1).

Table 1. Description of inputs and outputs of state-owned and private construction companies.

	Input						Output	
	Cost of Revenue (Billion IDR)		Operating Expenses (Billion IDR)		Total Assets (Billion IDR)		Revenue (Billion IDR)	
	SOE	Private	SOE	Private	SOE	Private	SOE	Private
Mean	16,946	2423	1638	265	55,624	3681	19,737	2833
Median	14,295	2227	1125	193	51,805	3236	16,325	2629
Stand dev	7367	1318	1332	169	29,781	2006	9160	1555
Minimum	8415	226	395	93	16,761	819	9390	413
Maximum	39,926	5231	5433	786	124,392	10,447	48,789	6040

Figure 5 shows the average efficiency of state-owned and private construction companies in Indonesia under Constant Return to Scale (CRS) conditions during 2015–2022. Both state-owned and private construction companies have relatively high-efficiency values. However, this efficiency value is relative to the company with the highest efficiency value, BUKK.

Based on Figure 6, it can be seen that private companies (except ACST) have higher efficiency than state-owned companies. State-owned companies such as WIKA and WSKT experienced a significant decline in efficiency in 2020. The same thing happened to all private companies. However, the efficiency scores of SOEs and private companies started improving in 2021. The lower efficiency of SOEs compared to the private sector is validated through the *t*-test with a value of $t = -2.701$ and p -value = 0.008916, meaning there is enough evidence to reject the null hypothesis or to state that there is a significant difference in the efficiency of the two groups.

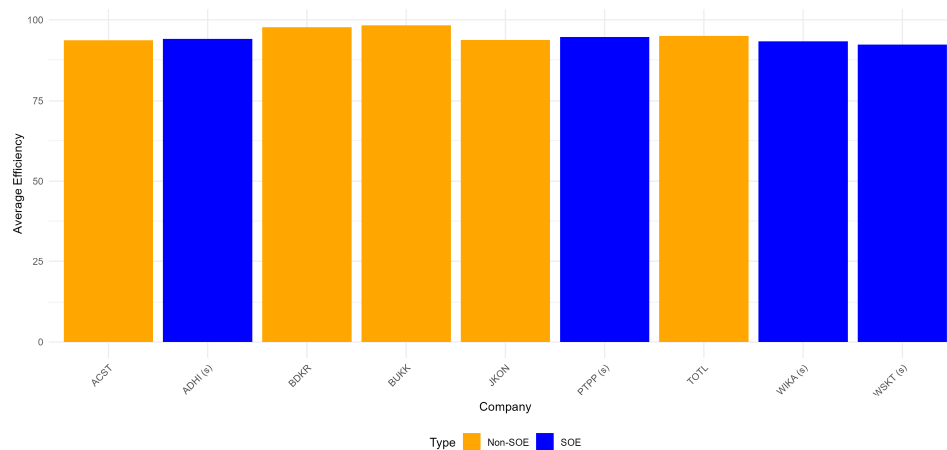


Figure 5. The average efficiency of state-owned and private construction companies.

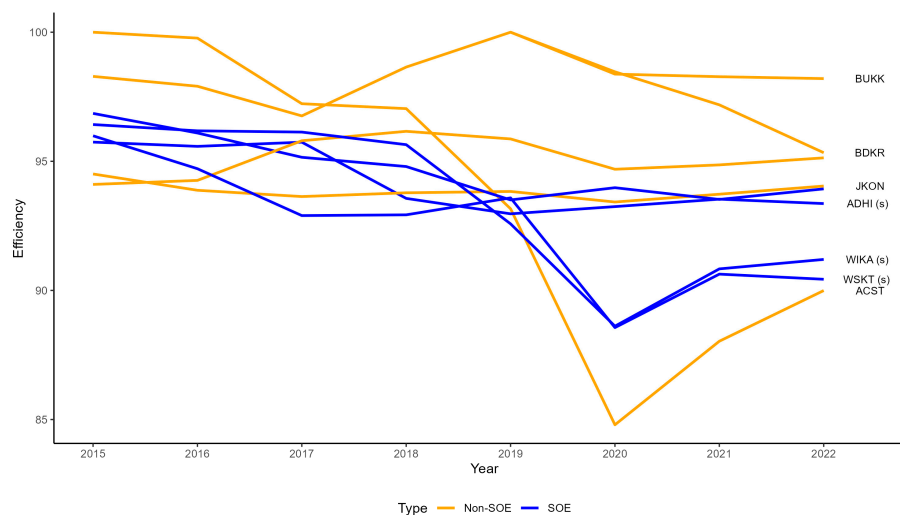


Figure 6. Efficiency of state-owned and private construction companies.

5. Discussion

The performance of financial ratios of state-owned construction companies through the measurement of profitability, liquidity, and solvency (leverage) ratios based on Peterson's (2013) construction sector financial ratio goodness measure shows that the four state-owned construction companies have poor performance. This is in line with Utamaningsih and Muharis (2020), where the evaluation of solvency and liquidity shows that SOEs are less able to use their debt to finance all their assets, as well as their low ability to pay their debts. State-owned construction companies have experienced a decline in financial performance, especially during the COVID-19 pandemic in Indonesia (Muhammad and Rahadi 2023). Continuous analysis of a firm's liquidity, profitability, capital structure, activity efficiency, profit margin, growth, and asset structure factors, as identified by Emin et al. (2007), provides sufficient information related to the relative state of the industry and each construction company concerning time and economic changes.

Low profitability in state-owned construction companies is caused by the large gap between gross profit margin and net profit margin, which is influenced by cost overruns for materials, equipment, subcontractors, and financial and administrative expenses (Utamaningsih and Muharis 2020). High solvency indicates a significant dependence of SOEs on debt to carry out their business activities, in contrast to private companies with lower debt levels (Sukandar et al. 2018). Having more debt than necessary can seriously increase the company's interest costs. It can also lead to a sharp increase in the company's financial risk. Therefore, the company's debt burden greatly influences its financial stability (Mohammed

2007). The more significant the portion of debt capital, the more likely the company is to experience the risk of bankruptcy (Van Horne 1983).

Short-term loans are the leading indicator of operational funding for state-owned construction companies, leading to high loan interest expenses and eroding profitability. Short-term loans pose a greater risk to the company than long-term funding. This happens because the interest costs will fluctuate more, so that the risk of inability to repay the debt is greater (Brigham and Gapenski 1994). The proportion of bank debt to the total liabilities of state-owned construction companies is quite significant, such as WSKT at 56.5%, PTPP at 30.6%, and ADHI at 33.5%. In addition to loans, the companies also have trade payables to suppliers and subcontractors. Liquidity ratios close to 0 or negative indicate that state-owned construction companies are in critical cash condition. In contrast, private companies with lower DER indicate a more conservative and sustainable financial strategy in the long term (Hariandja et al. 2022; Septian et al. 2021).

This study also shows that state-owned construction companies have a relatively low efficiency level compared to private construction companies. The performance gap between SOEs and private companies is often attributed to inefficiencies in using inputs to produce outputs (Soetanto and Fun 2014). Significant assets and revenue do not necessarily increase efficiency, mainly if financed by high debt (Sufian and Shah Habibullah 2010). Nevertheless, research by Sukandar et al. (2018) revealed that state-owned construction companies are more efficient than private companies. This is due to the government's availability of many projects of value. State-owned companies with high debt are still efficient because they have an excellent income value from government projects.

The five business segments of state-owned construction companies (infrastructure, building, energy, industry, and investment) show that efficient input allocation is essential to produce profitable outputs. However, poor performance in some business segments suggests inefficiencies in resource allocation (Utamaningsih and Muharis 2020). For example, WIKA experienced negative profits in the investment and property segments, while ADHI experienced significant losses in the rail and infrastructure construction segments.

Overall, state-owned construction companies need more capital to finance their projects and business operations, as evidenced by high debt levels and low revenues. The government needs to find new sources of capital or financing schemes that can ease the burden on companies in managing government projects. In addition, companies should implement a focused strategy to optimize profitable business segments and carry out business transformation to avoid further losses.

Limited cash liquidity affects the selection of market segments and project investments. Factors such as technical capabilities, experience in each value chain stage, and the ability to act as a leader or supporter are also vital considerations. In the current situation, the business focus should be limited to each phase with the following strategies: (1) accelerate the collection of receivables and strengthen liquidity through debt restructuring, accelerated collectability, additional capital deposits, and divestment; (2) avoid unnecessary investments; (3) focus on asset recycling; and (4) improve project efficiency.

This study reveals the financial performance of state-owned construction companies and compares them with private construction companies using only secondary data, so the details of the analysis are only superficial. To understand the problem of SOE construction performance in more depth, it is necessary to conduct further analysis through strategic studies on all SOE construction companies. A strategic management study with primary data collection could address the shortcomings of this research and provide more comprehensive insights.

6. Conclusions

The financial performance of Indonesian SOEs has been declining, prompting a need to identify the underlying causes. This study evaluates whether similar issues affect private companies and determines if the trends stem from broader industry weaknesses or specific inefficiencies in SOEs compared to private counterparts. Using financial ratio

analysis and data envelopment analysis (DEA), we quantitatively assessed the efficiency and financial performance of these companies over the selected period. The study results show that the financial ratio performance of state-owned companies is relatively poor, with low profitability, critical liquidity, and a high debt ratio. Debt, as a source of capital in financing construction projects, makes companies face a greater debt risk. This study validates that SOEs have lower efficiency compared to private companies. In response to current challenges, SOEs should prioritize the following: (1) enhancing liquidity through faster receivable collections, debt restructuring, capital infusions, and divestment; (2) curtailing non-essential investments; (3) focusing on asset recycling; and (4) improving project efficiency.

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Appendix A

Table A1. List of variables used.

No.	Variables
Financial Ratio Variables	
1.	Quick Ratio (QR)
2.	Current Ratio (CR)
3.	Gross Profit Margin (GPM)
4.	After Tax Profit Margin Ratio (ATPM)
5.	Return on Asset (ROA)
6.	Return on Equity (ROE)
7.	Current-Liabilities-to-Net-Worth Ratio (CLNWR)
8.	Debt-to-Equity Ratio (DER)
9.	Accounts-Payable-to-Revenue Ratio (APRR)
Input-Output Variables	
1.	Revenue (Output)
2.	Operating Expenses (Input)
3.	Cost of Revenue (Input)
4.	Total Assets (Input)

Appendix B

Table A2. Sample list of construction companies.

Company	Description
ACST	PT Acset Indonusa Tbk
ADHI(s)	PT Adhi Karya (Persero) Tbk
BDKR	PT Berdikari Pondasi Perkasa Tbk
BUKK	PT Bukaka Teknik Utama Tbk
JKON	PT Jaya Konstruksi Manggala Pratama Tbk
PTPP(s)	PT Housing Development (Persero) Tbk
TOTL	PT Total Bangun Persada Tbk
WIKAS)	PT Wijaya Karya (Persero) Tbk
WSKT (s)	PT Waskita Karya (Persero) Tbk

Appendix C

Table A3. Benchmark financial ratios.

No.	Ratio	Industry Average	Range
1	Quick Ratio (QR)	120%	60%–190%
2	Current Ratio (CR)	150%	120%–280%
3	Gross Profit Margin (GPM)	16%	
4	After Tax Profit Margin Ratio (ATPM)	1.9%	0.5%–8.1%
5	Return on Asset (ROA)	5.6%	1.5%–21%
6	Return on Equity (ROE)	15.1%	4.2%–53%
7	Current-Liabilities-to-Net-Worth Ratio (CLNWR)	123%	38%–259%
8	Debt-to-Equity Ratio (DER)	140%	50%–280%
9	Accounts-Payable-to-Revenue Ratio (APRR)	8.2%	3.1%–13.3%

Appendix D

Table A4. Average liquidity ratio of state-owned and private construction companies.

Liquidity Ratio				
Company	Quick Ratio	Benchmark	Current Ratio	Benchmark
ACST	26%		123%	
ADHI(s)	36%		127%	
BDKR	98%		124%	
BUKK	50%	Average: 120% Range: 60%–190%	122%	Average: 150% Range: 120%–280%
JKON	90%		168%	
PTPP(s)	56%		132%	
TOTL	82%		139%	
WIKa	51%		129%	
WSKT	33%		116%	

Description: (s): State-owned company.

Appendix E

Table A5. Average profitability ratio of state-owned and private construction companies.

Profitability Ratio								
Company	GPM	Benchmark	ATPM	Benchmark	ROA	Benchmark	ROE	Benchmark
ACST	−0.1%		−27%		−8.28%		−99.44%	
ADHI(s)	13.73%		2.62%		1.48%		6.5%	
BDKR	46.18%		14.05%		5.62%		10.61%	
BUKK	16.95%	Average: 16%	8.79%	Average: 1.9% Range: 1.5%–8.1%	8.59%	Average: 5.6% Range: 1.5%–21%	16.74%	Average: 15.1% Range: 4.2%–53%
JKON	15.96%		4.1%		4.61%		8.66%	
PTPP(s)	14.16%		3.96%		2.31%		9.63%	
TOTL	14.3%		6.92%		5.68%		17.08%	
WIKa(s)	11.31%		3.92%		2.28%		8.42%	
WSKT(s)	14.84%		−4.07%		1.02%		−3.64%	

Description: (s): State-owned company.

Appendix F

Table A6. Average leverage ratio of state-owned and private construction companies.

Leverage Ratio						
Company	CLNWR	Benchmark	DER	Benchmark	APRR	Benchmark
ACST	709%		265.98%		53%	
ADHI(s)	337%		130.2%		73%	
BDKR	59%		50.62%		5%	
BUKK	76%	Average: 123% Range: 38%–259%	34.83%	Average: 140% Range: 5%–280%	10%	Average: 8.2% Range: 3.1%–13.3%
JKON	63%		23.13%		7%	
PTPP(s)	184%		97.7%		75%	
TOTL	161%		1.15%		7%	
WIKa(s)	187%		106.04%		50%	
WSKT(s)	212%		283.22%		45%	

Description: (s): State-owned company.

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Article

Navigating the Storm: How Economic Uncertainty Shapes Audit Quality in BRICS Nations Amid CEO Power Dynamics

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Abstract: This study investigates the association between economic uncertainty and audit quality in the BRICS nations, examining both input-based (e.g., audit fees, auditor tenure) and output-based (e.g., restatements, total accruals) measures of audit quality. Utilizing a dataset of 83,511 firm-year observations from 1995–2022, it reveals a significant negative impact of economic uncertainty on audit quality. Additionally, the research explores the moderating role of CEO power, employing principal component analysis to merge various indicators of CEO influence. Findings indicate that powerful CEOs can mitigate the adverse effects of economic uncertainty on audit quality, suggesting a U-shaped relationship between CEO power and audit quality. Methodologically robust, employing techniques like two-stage least squares (2SLS) and two-stage system generalized method of moments (system GMM) to address endogeneity, the study offers a comprehensive analysis of audit quality in the context of economic fluctuations and corporate governance, contributing significantly to the understanding of these dynamics in emerging economies, particularly in the diverse and influential BRICS nations. This study's findings have significant implications for stakeholders and policymakers, providing insights that can inform policy decisions and enhance corporate governance frameworks.

Keywords: economic uncertainty; audit quality; BRICS nations; CEO power

1. Introduction

The dynamic and interrelated nature of the global economic environment requires a detailed comprehension of the forces that influence its condition and dynamics. Economic uncertainty is a crucial factor that significantly impacts many economic activities and corporate strategies (Al-Thaqeb and Algharabali 2019; Irwin et al. 2022; Li et al. 2023a). This paper aims to explore the relationship between economic uncertainty and its effects, with a specific focus on audit quality and corporate governance in the BRICS nations (Brazil, Russia, India, China, and South Africa).

Economic uncertainty refers to the inherent ambiguities and unpredictabilities found in economic situations, encompassing market shifts, policy changes, and geopolitical movements (Dokas et al. 2023). Studies such as those by Baker et al. (2016), Shabir et al. (2021), and Khoo and Cheung (2021) have underscored the catalytic role of uncertainty in driving business fluctuations, influencing market players' attitudes, and necessitating adjustments in remuneration structures. The condition of uncertainty has extensive consequences, impacting investment choices, financial decision-making, market behavior, innovation, supply chain management, and risk management.

Despite the extensive impact of economic uncertainty, its effect on audit quality has received limited attention from researchers and academia, with findings being controversial. For instance, Zhang et al. (2018) found that both Big 4 and non-Big 4 auditors reduce their fees during times of economic uncertainty, with non-Big 4 auditors showing asymmetric pricing adjustments. On the contrary, Chen et al. (2019) observed a negative correlation between macroeconomic uncertainty and audit fees, particularly in firms using Big 4 and

specialist auditors. Yun and Chun (2021) and Lee and Jeong (2023) suggest that economic uncertainty leads to increased audit hours and efforts, suggesting enhanced audit quality and more rigorous financial reporting during such periods. This research, therefore, aims to elucidate the impact of economic uncertainty on both input-based measures (e.g., audit fees, auditor tenure) and output-based measures (e.g., restatements, total accruals) of audit quality.

Furthermore, while previous studies have examined the variations in audit quality features during uncertain periods, none have specifically examined the influence of corporate governance factors, such as CEO power. CEOs play a crucial role in strategic decision-making, resource allocation, and shaping the future direction of their companies, especially during periods of economic uncertainty (Haynes and Hillman 2010; Graham et al. 2015; Faccio et al. 2016). Nevertheless, existing data indicate that CEOs exhibit distinct management styles in different nations, influenced by varying rules, stock market conditions, and investment strategies (Crossland and Hambrick 2011; Nielsen and Nielsen 2011). This study investigates how CEO power moderates the impact of economic uncertainty on audit quality, examining the extent to which powerful CEOs influence decision-making processes related to financial reporting and audits during uncertain times.

Overall, the primary objective of this study is to investigate how economic uncertainty affects audit quality in the BRICS nations. Specifically, this research seeks to (a) analyze the impact of economic uncertainty on both input-based and output-based measures of audit quality, (b) examine the moderating role of CEO power in the relationship between economic uncertainty and audit quality, and (c) provide a comprehensive analysis of audit quality in the context of economic fluctuations and corporate governance in emerging economies. Accordingly, the hypotheses guiding this research are H1—Economic uncertainty has an impact on audit quality and H2—CEO power moderates the impact of economic uncertainty on audit quality.

The main findings of this paper are outlined as follows. Based on an analysis of 83,511 firm-year observations over the period of 1995–2022 in BRICS nations, we have discovered that a rise in economic uncertainty has a substantial negative impact on both input-based measures (e.g., audit-fees-to-total-fees ratio and auditor tenure) and output-based measures (e.g., restatements and total accruals) of audit quality. Furthermore, we broadened our investigation to see whether the influence of CEO power has served as a moderating factor in reducing the negative effects of economic uncertainty on audit quality. To assess CEO power, we employ principal Component Analysis, a data reduction technique, to merge five distinct indicators of CEO power (e.g., CEO duality, CEO-founder, CEO ownership, CEO compensation slice, and CEO tenure). The findings demonstrate that influential CEOs play a vital role in reducing the negative impact of economic uncertainty on the quality of audits. In addition, we conduct several tests to ensure the reliability of our findings. We consider additional measures of audit quality, alternative indicators of economic uncertainty, and CEO power, and address potential endogeneity issues by employing two-stage least squares (2SLS) and two-stage system generalized method of moments (system GMM) estimate techniques. Our results remain consistent throughout these numerous analyses.

This study contributes to the existing literature in five important ways. First, our research is a comprehensive analysis of the impact of economic uncertainty on audit quality in BRICS nations, employing a large dataset of 83,511 firm-year observations from 1995 to 2022. The study finds a significant negative impact on both input-based (audit-fees-to-total-fees ratio, auditor tenure) and output-based measures (restatements, total accruals) of audit quality using the world uncertainty index that Ahir et al. (2022) developed to quantify economic uncertainty. This finding contrasts with previous studies by Yun and Chun (2021) and Lee and Jeong (2023), which suggest increased audit efforts during uncertain periods. This study also shows that higher audit risks lead to higher audit fees and hours, which is similar to what Zhang et al. (2018) found and shows how complicated the relationship is between audit fees, audit hours, and audit quality. Finally, the research underscores the

exacerbation of information asymmetry during economic uncertainty, as noted by Tessema (2020) and Lee and Jeong (2023), challenging auditors to gather accurate information, thereby impacting the reliability of audits.

Second, our research provides an important academic contribution by examining the influence of CEO power as a moderating element in the effect of economic uncertainty on audit quality, specifically in BRICS nations. Utilizing a CEO power index that considers factors such as CEO duality, ownership, and tenure, the study supports previous research conducted by Jensen (1993) and Hermalin and Weisbach (1998) about the impact of CEO positions within an organizational framework. The statement recognizes the two-sided aspect of CEO power, as suggested by economic and organizational theories. CEO power can have both positive and negative effects on business performance and efficiency. Li et al. (2017) and Bristy et al. (2022) conducted research to support this idea. This study presents evidence of a U-shaped relationship between CEO power and audit quality. It suggests that CEO power can mitigate the adverse impact of economic uncertainty on audit quality. This finding aligns with the conclusions drawn by Ouyang et al. (2015) and Azizan (2019) regarding the influence of CEOs on financial reporting and auditing procedures. The study utilizes principal component analysis to evaluate CEO power, ensuring a thorough and comprehensive assessment of this intricate concept. Additionally, the study validates its conclusions through many analyses and tests. This study makes a substantial contribution to the comprehension of corporate governance and audit quality in developing economies. It emphasizes the intricate and influential position of CEO power in the midst of economic uncertainty.

Third, utilizing a substantial dataset and employing sophisticated statistical techniques such as 2SLS and system GMM to tackle potential endogeneity problems enhances the methodological robustness of the research. The conclusions of the study are academically credible since they are supported by consistent results from several tests and alternative metrics, which demonstrate their dependability and robustness.

Fourth, the inclusion of BRICS nations in our study offers a vital contribution to the global literature and has significant implications for the global economy. This is due to the unique economic and governance systems of these nations, their representation of emerging markets, and their substantial combined economic influence (Nayyar 2018; Larionova and Shelepov 2022). The BRICS nations provide a diverse perspective on the effects of economic uncertainty and CEO power on audit quality, enriching the predominantly developed economies' global view. Their diverse regulatory, economic, and cultural contexts further enhance this perspective. Given their significant role in the global financial system, coupled with their large share of the world's population and GDP, the corporate governance and financial reporting practices in BRICS countries have far-reaching impacts on global trade, investment flows, and economic stability (Vom Hau et al. 2012; Nölke et al. 2015). Additionally, insights gained from these nations can serve as valuable models for other developing economies, establishing benchmarks for improving audit quality and corporate governance standards. Therefore, examining BRICS nations is not only intellectually stimulating but also essential for understanding and navigating the complexities of the global economic landscape.

Fifth, the implications of this research are significant for policymakers, corporate stakeholders, and auditors. By highlighting the negative impact of economic uncertainty on audit quality and the mitigating role of CEO power, this study provides valuable insights that can inform policy decisions aimed at enhancing audit practices and corporate governance frameworks, particularly in emerging economies like the BRICS nations. Policymakers can utilize these findings to develop strategies that bolster audit quality during periods of economic uncertainty, ensuring more reliable financial reporting and greater market stability. Additionally, stakeholders and auditors can better understand the dynamics of CEO influence in mitigating adverse effects on audit quality, thereby enabling more effective oversight and improved corporate governance practices. This comprehensive

analysis not only contributes to the academic literature but also offers practical guidance for managing audit quality amid economic fluctuations and varying levels of CEO power.

The structure of this paper is as follows. Section “Literature Review and Hypotheses Development” provides a concise overview of the relevant literature and formulates our hypothesis. Section “Data and Methodology” provides an explanation of the data and the empirical approach. Section “Results and Discussion” presents the estimation results of our baseline model. Section “Robustness Checks” presents a series of robustness checks. Section “Implications” presents the study’s practical and theoretical implications. The final section is concluded.

2. Literature Review and Hypotheses Development

2.1. The Role of BRICS in the International Economic System

BRICS is an acronym for Brazil, Russia, India, China, and South Africa. Jim O’Neill, an economist at Goldman Sachs, first used the term in 2001 as BRIC (excluding South Africa). He believed that by the year 2050, the four BRIC economies would emerge as dominant forces in the world economy. The inclusion of South Africa on the list occurred in 2010. The BRICS countries function as an intergovernmental organization with the objective of promoting economic cooperation among their member nations and enhancing their global economic and political influence. During its annual conference held in Johannesburg in August 2023, BRICS countries disclosed their intentions to pursue expansion, marking the first such endeavor since 2010. On 1 January 2024, the BRICS alliance is set to expand its membership by including six additional countries, namely Saudi Arabia, Argentina, Egypt, Ethiopia, Iran, and the United Arab Emirates. The proposed expansion will serve to solidify the group’s position as a viable alternative to the G7’s dominant global influence. This expansion will result in the BRICS countries collectively accounting for 26% of the global gross domestic product (GDP) and encompassing approximately half of the world’s population. The BRICS, in light of numerous states demonstrating their inclination to join the alliance, are evidently strategizing their stance in preparation for a multipolar global order wherein the dominance of the United States and other Western nations is not prevalent.

The BRICS countries have experienced significant growth in their proportion of the global GDP, which serves as an indicator of their increasing economic influence (Lowe 2016). The GDP of these countries has experienced a notable increase, rising from 7.83% in 1995 to 25.77% in 2022. This trend of growth underscores their substantial role in fostering global economic expansion. The forecast that China and India will ascend to the positions of the first and third largest economies, respectively, by 2050, while Russia and Brazil will also rank among the top six, highlights the changing power dynamics within the global economy, with a notable shift towards these growing countries (Cheng 2015).

BRICS nations, with over 40% of the global population, have a vast workforce and consumer base. The demographic advantage present in this context not only serves to foster economic growth within the home sphere but also generates substantial markets for international trade and investment (Jafrin et al. 2021). The substantial population indicates the possibility of a sizable workforce that may contribute to the international supply chain and stimulate worldwide demand for goods and services (Lowe 2016; Jafrin et al. 2021).

The BRICS nations exert a significant influence on the patterns of international trade. These countries possess considerable importance as both exporters and importers, and they play a crucial role in the transfer of environmental and resource consumption via trade (Lowe 2016; Tian et al. 2020). The heightened economic activity they engage in plays a role in the transformation of conventional economic power hubs and the modification of global trade patterns (Lowe 2016).

The BRICS countries add to the global economy’s diversity through their unique economic structures. The global economy benefits from the stability derived from the diversification of industries and markets, facilitated by the presence of Russia’s energy resources, India’s services sector, and China’s manufacturing base (Goldstein 2013; Li 2019). This

diversity effectively distributes risks and opportunities across multiple sectors, contributing to the overall resilience of the global economic system (Goldstein 2013; Li 2019).

The BRICS nations play a pivotal role in global sustainability issues owing to the significant magnitude of their environmental influence (Tian et al. 2020). The methodology employed by the authors in addressing the challenges associated with urbanization and industrialization, as well as their tactics for integrating renewable energy sources and implementing sustainable practices, possess the capacity to establish benchmarks for other emerging countries (Tian et al. 2020).

The BRICS nations are key to global discussions on sustainability due to the scale of their environmental impact (Tian et al. 2020). Their approaches to tackling issues of urbanization and industrialization and their strategies for incorporating renewable energy and sustainable practices have the potential to set precedents for other developing nations (Tian et al. 2020).

2.2. Financial Reporting in BRICS Countries

The application of International Financial Reporting Standards (IFRS) and the legal and regulatory framework have a significant impact on the caliber and comparability of financial reporting among BRICS nations (Chen and Cheng 2007; Ali and Ahmed 2017). The adoption and impact of IFRS vary throughout BRICS nations, indicating that institutional elements, including enforcement procedures and regulatory frameworks, have a key role in shaping the consequences of IFRS adoption (Combs et al. 2013; Gu et al. 2019).

In Brazil, the adoption of IFRS, guided by local laws and governance codes, has resulted in higher-quality financial disclosures and reduced the cost of capital, as studies by Da Silva and Nardi (2017) and de Lima et al. (2018) demonstrate. Despite this, there's a spectrum of impacts ranging from improved market relevance of financial data to inconsistent effects on forecasting and decision-making, as indicated by Eng et al. (2019) and Castro and Santana (2018). Similarly, in Russia, having to use IFRS has improved the quality of financial reporting, with researchers like Kim (2016) and Bagaeva (2008) noticing that it has made values more relevant and conservative. However, using IFRS along with Russian Accounting Standards creates its own challenges.

In contrast, India's transition to IFRS has been fraught with obstacles, including training and infrastructure issues. According to research by Uzma (2016) and Krishnan (2018), factors like capital structure and auditor type have mixed effects on companies. China's IFRS adoption since 2005 has improved disclosure and reduced earnings manipulation, aligning with its neoliberal economic trends (Lam et al. 2013; Elshandidy 2014), although subsequent reforms have shown diverse outcomes, as observed by Barhamzaid (2019). South Africa's experience since mandating IFRS reflects enhanced earnings quality and governance correlation, notwithstanding concerns about compliance costs and institutional weaknesses. Nevertheless, IFRS has significantly improved financial information quality, particularly in the banking sector, as Ghio and Verona (2015) and Uzma and Nurunnabi (2021) have noted. These global experiences emphasize the transformative but complex influence of IFRS on financial reporting and governance.

2.3. Auditing in BRICS Countries

The audit systems in BRICS countries exhibit a wide range of economic underpinnings and regulatory landscapes, with each country adjusting its system to suit its specific environment while also gradually conforming to global standards. Brazil has experienced a significant economic transformation from a predominantly agrarian society to an industrialized economy. As part of this transition, Brazil has developed a strong accounting system that has been influenced by European and American practices. This system is regulated and supervised by key organizations such as the Commission of Security (CVM, Comissão de Valores Mobiliário) and the Central Bank (BCB, Banco Central do Brasil) (Provasi 2013; Kleinman et al. 2014). Despite some differences in areas like asset re-evaluation and financial leasing, the implementation of Brazilian GAAP demonstrates its convergence with

international standards (Provasi 2013). In contrast, India has experienced significant economic growth since 2003, primarily due to the services sector. The Institute of Chartered Accountants of India (ICAI), as a regulatory body, demonstrates a notable predisposition towards international standards through the implementation of 35 accounting standards. However, it is important to note that the ICAI also incorporates distinct modifications in certain areas, such as financial statements and foreign currency treatments, as highlighted by Provasi (2013) and Kleinman et al. (2014). The Indian auditing system places significant emphasis on the International Auditing Practices Committee and the Auditing and Assurance Standards Board. This indicates a progressive and consistent integration of International Standards on Auditing (ISA) norms into the system (Provasi 2013).

Similarly, the audit systems of Russia and China exhibit differing characteristics due to their unique socio-economic transitions, and these systems are also subject to ongoing changes and developments. The transition of Russia from a Soviet-era economic system to a market-oriented one required the establishment of additional regulatory institutions, such as the Institute of Professional Accountants of Russia (IPAR). This was conducted in order to facilitate the alignment of Russian Accounting Standards (RAS) with IFRS, aiming for greater consistency and compatibility. Despite the advancements made in this area, notable disparities persist, including the failure to implement fair value and the presence of obstacles to achieving transparency and maintaining auditing independence (Provasi 2013; Kleinman et al. 2014). China, in the process of shifting from a centrally planned economy to a market-oriented one, has formulated the China Accounting Standards (CAS) and subsequently introduced the Accounting System for Business Enterprises (ASBE). These accounting frameworks have been designed to harmonize various procedures with international standards; however, many discrepancies exist, particularly in relation to asset valuation methods. The Chinese auditing system has undergone notable progress in recent years, namely in the integration of its standards with the International Standards on Auditing (ISA) (Provasi 2013; Kleinman et al. 2014). This development is particularly noteworthy, considering the system's deep historical roots.

2.4. Audit Quality under Agency Theory

Audit quality under agency theory is a crucial concept as it addresses the mechanisms by which principals (such as shareholders) can ensure that agents (such as managers) act in the principals' best interests. Agency theory, as proposed by Jensen and Meckling (1979), suggests that there is an inherent conflict of interest between principals and agents due to differing goals and the information asymmetry that exists between them. This conflict leads to agency costs, which include monitoring costs borne by the principal, bonding costs borne by the agent, and residual loss due to divergence of interests. External audits are a key mechanism to reduce these agency costs by providing independent verification of the financial information provided by agents, thereby reducing information asymmetry and opportunistic behavior by agents (Fossung et al. 2022; Rahman et al. 2023).

Furthermore, according to Jensen and Meckling (1979), the separation of ownership and control in a company creates potential conflicts of interest. Managers may pursue personal benefits rather than maximizing shareholder value. The demand for high-quality external audits is thus driven by the need to monitor and control managerial behavior, ensuring that managers act in the best interest of shareholders. Fossung et al. (2022) indicate that higher managerial ownership might reduce the demand for external audit quality as managers' interests align more closely with those of shareholders.

Agency theory also addresses conflicts between shareholders and creditors (Jensen and Meckling 1979). Shareholders may prefer riskier projects since they benefit from the upside, while creditors prefer safer projects to ensure repayment (Adams 1994). High-quality audits can reduce this conflict by providing reliable financial information, thus reassuring creditors about the company's financial health. This helps in lowering the cost of debt and improving the firm's creditworthiness. However, the relationship between

indebtedness and demand for audit quality has produced mixed empirical results (Adams 1994; Rahman et al. 2023).

2.5. Economic Uncertainty, Audit Quality, and CEO Power

The existing body of literature provides substantial evidence to support the notion that economic uncertainty plays a crucial role in influencing company dynamics and has a considerable impact on numerous aspects of economic activities and corporate strategies. In their studies, Baker et al. (2016) as well as Shabir et al. (2021) have emphasized the significant role of uncertainty as a key catalyst for business fluctuations and its detrimental impact on economic activity, hence hindering the speed of recovery. Additionally, Khoo and Cheung (2021) emphasizes that the increasing level of uncertainty not only impacts the attitudes of market players but also results in a need for greater remuneration, significantly influencing company plans. Numerous academic studies have extensively examined the varied consequences of uncertainty on several aspects of corporate operations, such as investment decisions (Al-Thaqeb and Algharabali 2019; Jackson and Orr 2019; Chu and Fang 2021; Kong et al. 2022), financial decision making (Lee et al. 2017; Tran 2019), market behavior and competition (Shabir et al. 2021; Desalegn et al. 2023), innovation and R&D (Saleem et al. 2018; Xu 2020; He et al. 2020; Cui et al. 2021; Tajaddini and Gholipour 2021), supply chain management (Charoenwong et al. 2023), consumer behavior and demand (Nguyen et al. 2020; Kuok et al. 2023), risk management and contingency planning (Hammoudeh and McAleer 2015; Chen et al. 2021), financial performance and reporting (Ozili 2021; Bermpei et al. 2022), mergers and acquisitions (Bonaime et al. 2018; Sha et al. 2020; Paudyal et al. 2021), sustainability and environmental impact (Ahmed et al. 2021; Xue et al. 2022), operational efficiency and cost management (Liu and Wang 2022), and insurance and risk transfer (Gupta et al. 2019), among other areas.

Information asymmetry is another consequence of economic uncertainty (Al-Thaqeb and Algharabali 2019). Research has indicated that the presence of political or policy uncertainty, commonly referred to as economic uncertainty, has an impact on both the extent and caliber of company disclosure (Lei and Luo 2023). According to Nagar et al. (2019), the presence of uncertainty leads to an expansion of bid-ask spreads and a reduction in the magnitude of stock market responses to earnings shocks, which suggests the existence of elevated levels of information asymmetry. According to Wellman (2017), political relationships have the potential to mitigate the adverse consequences of uncertainty and information asymmetry. The author contends that it is imperative for companies to allocate resources towards establishing and maintaining these ties in order to mitigate the level of uncertainty. This elucidates the significance and advantages of forging fresh contacts with politicians and lawmakers. In a similar vein, the study conducted by Farooq and Ahmed (2019) demonstrates that economic uncertainty exerts unequal impacts on dividend distributions within the United States. The research findings indicate that companies tend to distribute higher dividends in the context of a presidential election due to the presence of uncertainties surrounding monetary, fiscal, and national policies. The authors propose that the provision of larger dividends may serve as a potential mitigating factor in addressing the dangers entailed by uncertainty. According to Tang and Wan (2022), there exists a positive correlation between economic uncertainty and stock price informativeness, suggesting that economic uncertainty has the potential to impact the level of information asymmetry.

The presence of information asymmetry exerts an impact on the quality of audits. Several studies have indicated a negative relationship between higher levels of information asymmetry and audit quality, while a positive relationship has been observed between lower levels of information asymmetry and audit quality (Tessema 2020; Tessema and Abou-El-Sood 2023; Lee and Jeong 2023). In their study, Hakim and Omri (2010) see a negative correlation between the bid-ask spread, a market-based indicator of information asymmetry, and the utilization of audit industry specialists and large auditing firms. Conversely, they find a positive association between the bid-ask spread and the duration of the audit firm's tenure. According to Clinch et al. (2012), the selection of auditors

who are both from Big-n firms and possess audit industry specialization is linked to a reduction in information asymmetry. According to the findings of Ghanbari et al. (2018), a notable and statistically significant correlation exists between agency expenses and audit quality, indicating a negative association between these two variables. Furthermore, the findings indicate a substantial and positive correlation between the quality of audits and the presence of information asymmetry.

While previous studies on economic uncertainty have predominantly examined it from an economics or finance standpoint, Zhang et al. (2018) established a connection between economic uncertainty and auditors' initial responses to it. Zhang et al. (2018) investigate the differences in audit pricing between Big 4 and non-Big 4 auditors in eight countries (Canada, France, Germany, India, Italy, Spain, the USA, and the UK). The findings reveal that both types of auditors reduce their fees when economic uncertainty increases, but non-Big 4 auditors adjust their pricing asymmetrically. Chen et al. (2019) utilize the volatility index provided by the Chicago Board Options Exchange as a proxy for measuring macroeconomic uncertainty. By examining a sample of U.S. firms spanning the years 2002 to 2014, their research demonstrates a negative correlation between macroeconomic uncertainty and audit fees. Furthermore, they find that the reduction in fees during periods of heightened uncertainty is particularly significant for firms that engage Big 4 and specialist auditors, as well as for firms with stronger financial positions. Yun and Chun (2021) suggest that there exists a positive correlation between Korean economic uncertainty and audit hours, suggesting that auditors tend to allocate more time to auditing when firms face elevated levels of economic uncertainty due to the increased risk of earnings manipulation. Moreover, the empirical findings indicate that auditors tend to increase their workload in terms of audit hours during fiscal years coinciding with presidential elections, particularly in the presence of elevated levels of economic uncertainty. Wang and Zhu (2022) conducted a study utilizing A-share-listed firms in China. Their findings indicate a positive relationship between economic uncertainty and abnormal audit fees. Moreover, they observe that this relationship is associated with a deterioration in the association between corporate risk-taking and abnormal audit fees. Further research shows that when economic uncertainty is high, auditors demand higher pay for audit risks and increase the amount of extra work they do. This makes the positive and negative abnormal audit fees stand out more. Lee and Jeong (2023) investigate the relationship between audit quality and the propensity for earnings management in the context of increased economic uncertainty in a manner akin to Yun and Chun's (2021) study. Their investigation is based on a sample of Korean companies listed on the stock exchange. Hence, it is observed that heightened levels of economic uncertainty led to an augmentation in audit quality, as indicated by factors such as audit fees, audit hours, amended disclosure of financial reports, and discretionary accruals. Additionally, it has been observed that in times of heightened economic uncertainty, corporations exhibiting a greater likelihood of engaging in profit manipulation tend to provide financial information of superior quality while simultaneously incurring lower expenses related to audit costs.

Based on the previously mentioned scholarly articles, it is evident that economic uncertainty has a significant impact on the presence of information asymmetry. This is accomplished through various means, including the disruption of investment decisions, the promotion of market volatility, the distortion of risk assessments, the hindrance of information disclosure, and the influence of resource allocation. The presence of a high level of uncertainty in economic policies results in an imbalanced dissemination of information across participants in the market, hence giving rise to discrepancies in comprehending the consequences of policy adaptations (Wellman 2017; Nagar et al. 2019). The absence of clear and predictable information leads to diverse interpretations and evaluations among investors, businesses, and stakeholders, hence promoting information asymmetry (Wellman 2017; Nagar et al. 2019; Tang and Wan 2022; Lei and Luo 2023). However, it's crucial to remember that information asymmetry can have a significant impact on audit quality. This is due to the fact that information asymmetry hinders the auditor's capacity to obtain

comprehensive and precise information, potentially resulting in reliance on biased or incomplete data provided by the client (Tessema 2020). The presence of information asymmetries has the potential to impede risk assessment, verification procedures, and the identification of any manipulation or misrepresentation of financial data. Consequently, this compromises the overall dependability of the audit (Tessema and Abou-El-Sood 2023; Lee and Jeong 2023). In this context, it is expected that economic uncertainty could potentially compromise the quality of audits by exacerbating information asymmetry in times of uncertainty.

On the contrary, the aforementioned articles suggest that economic uncertainty can have a beneficial impact on audit quality. This is due to the increased scrutiny and inspection that auditors have shown in response to potential dangers resulting from the presence of ambiguity. Regarding this matter, the existence of economic uncertainty frequently results in heightened vulnerabilities to earnings manipulation and financial irregularities within organizations (Nagar et al. 2019; Wang et al. 2023). In light of this awareness, auditors often intensify their audit endeavors during such periods (Yun and Chun 2021). Heninger's (2001) earlier research has shown that auditors work to improve their examination and methodologies in order to spot any potential earnings manipulation that might occur as a result of ambiguous economic policies. Furthermore, the prevailing economic uncertainties have led auditors to increase their audit fees (Wang and Zhu 2022). The rise in fees can be viewed as a form of compensation that accounts for the increased litigation and potential damage to reputation that may arise in an uncertain economic climate. The provision of financial incentives serves as a driving force for auditors to allocate additional resources and focus on conducting comprehensive examinations of financial statements with the aim of identifying any possible abnormalities (Wang and Zhu 2022). Consequently, it is anticipated that the quality of audits will enhance as auditors endeavor to manage and alleviate the risks linked to economic uncertainty (Lee and Jeong 2023). Alharasis (2023) and Alharasis and Mustafa (2023) found that audit fees in Jordanian listed firms, as a measure of audit quality, increased during the COVID-19 period, reflecting the higher demand for thorough audits during times of increased financial uncertainty and risk. They suggested that the COVID-19 pandemic led to government-mandated measures such as social isolation, lockdowns, shutdowns, and quarantines which significantly affected various aspects of auditing, including fees, staff wages, procedures, and the ability to accurately estimate future assessments. Consequently, these circumstances potentially jeopardized the quality of auditing work. In the same vein, Alharasis et al. (2024) provided empirical evidence that COVID-19 had a substantial impact on audit quality. The positive correlation between the pandemic and audit quality indicated that auditors had to enhance their audit practices to meet the higher standards required during the crisis. This included addressing issues related to fraud risk, financial instability, and regulatory compliance. Moreover, previous studies have demonstrated that auditors actively take into account the possibility of lawsuits and reputation threats when evaluating audit risk. Consequently, they make appropriate modifications to their audit methods (Latham and Linville 1998; Brasel et al. 2016). Taking a proactive approach enhances the likelihood of detecting and resolving probable instances of earnings manipulation (Hillegeist 1999), thereby leading to a decrease in abnormal accruals (Caramanis and Lennox 2008). Hence, during periods of increased earnings management risk, auditors are motivated to intensify their endeavors in order to identify and mitigate the risks associated with potential earnings manipulation. According to Alshabibi et al. (2021), audit quality during economic uncertainty, such as the COVID-19 pandemic, is significantly influenced by audit committee characteristics like size, independence, meeting frequency, gender diversity, and overlapping memberships. These factors enhance oversight, improve financial reporting, and ensure better disclosure of information, reducing information asymmetry and maintaining investor confidence. In this context, it is anticipated that there will be an enhancement in the overall quality of audits, which will have positive implications for both the audited organizations and the stakeholders who depend on the financial statements for making informed decisions.

Based on prior argumentation, it is anticipated that there exists a reciprocal relationship between economic uncertainty and audit quality. In analyzing the effect of economic uncertainty on audit quality under the lens of agency theory, it becomes evident that economic uncertainty can have both positive and negative impacts on audit quality. Under the positive perspective, economic uncertainty often prompts auditors to intensify their scrutiny and diligence due to heightened risks of financial misreporting and manipulation. This increased vigilance can enhance audit quality as auditors are more thorough in their examination to mitigate these risks. Furthermore, higher audit fees during uncertain times, as a form of compensation for increased litigation risks and reputational damage, can incentivize auditors to allocate more resources and efforts towards ensuring comprehensive audits. Under the negative perspective, economic uncertainty can exacerbate information asymmetry between management and auditors. Agency theory posits that managers may exploit this asymmetry to manipulate financial reports to meet targets or mask poor performance, thus compromising audit quality. Thus, while economic uncertainty can lead to more rigorous audits, it also poses significant challenges that can undermine audit quality, reflecting a complex interplay of factors as delineated by agency theory. Consequently, our initial hypothesis is formulated as follows:

H1: *Economic uncertainty has an impact on audit quality.*

The managerial power hypothesis is a concept in economics positing that those executives at the top inside a firm possess considerable influence and authority, leading to imbalances in negotiating power (Gioia and Sims 1983; Van Essen et al. 2015). This theory places significant emphasis on the influential role that executives hold inside a corporation, attributing their impact on decision-making to factors such as their position, experience, and control over crucial resources (Finkelstein 1992; Eisenhardt and Zbaracki 1992). Extensive research has been conducted to investigate the significant influence of top management on business performance, namely through their strategic decision-making and entrepreneurial behavior within organizational contexts (Papadakis et al. 1998; Engelen et al. 2015). The principal individuals responsible for formulating the strategic direction of a corporation are top-level managers, specifically the Chief Executive Officer (CEO) and other executives in the C-suite. These individuals utilize their expertise and leadership abilities to establish objectives and make critical choices that guide the organization's trajectory (Breene et al. 2007; Samimi et al. 2022). The significance of entrepreneurial behavior, which includes risk-taking and innovation, cannot be overstated in promoting growth and facilitating the ability of these enterprises to adapt to evolving market dynamics (Kuratko et al. 2004; Karneli 2023). The primary responsibility for strategic decision-making lies with the highest echelons of management, known as top management. However, the board of directors plays a crucial role in supporting this process by providing oversight and guidance (Kim et al. 2009). Nevertheless, the performance of a corporation is also dependent on various complicated aspects, including market conditions, competition, internal dynamics, and the impact of top management and entrepreneurial endeavors. The impact of the CEO on a company's performance in the corporate sector is a subject of academic research. However, existing research has not reached a consensus regarding the relationship between CEO power and firm performance (Bristy et al. 2022; Chiu et al. 2022). The CEO assumes a crucial position within the upper echelons of management, exerting significant influence in steering the organization towards favorable prospects and molding its strategic direction (Chiu et al. 2022). Economic theory views CEO power as a potential issue of agency, while organizational theory posits that it can also contribute to the improvement of business performance and efficiency (Shahab et al. 2020; Shahab et al. 2022). The influence of CEO power is complex, as it has been found to have both positive and negative effects. Economic theory argues that excessive CEO authority may be detrimental to shareholder interests. On the other hand, organizational theory posits that CEO power can enhance decision-making

and facilitate adaptation to market dynamics. Studies carried out by Li et al. (2017) and Bristy et al. (2022) support these findings.

Furthermore, the attributes of CEO power and dynamics exhibit a strong correlation with corporate governance, financial reporting, and auditing. A CEO with significant power has the ability to exercise a significant level of control over the processes related to financial reporting and disclosure, according to earlier research by Habib and Hossain (2013), Cormier et al. (2016), Lutfi et al. (2022), and Yami and Poletti-Hughes (2022). The management team may exert pressure or influence on the manipulation of financial information in order to achieve specific targets or expectations (Yami and Poletti-Hughes 2022), potentially compromising audit quality (Cohen et al. 2011; Bishop et al. 2017). The aforementioned influence has the potential to diminish the independence of the audit process. Additionally, the influence that CEOs have can potentially make the board of directors less effective at carrying out their oversight responsibilities (Tuggle et al. 2010; Haynes et al. 2019). The presence of an independent and attentive board is essential in guaranteeing the attainment of high standards in audit quality (Kleinman et al. 2014; Shan 2014). According to Carcello et al. (2011) and Ramanan (2014), the CEO may exert an excessive amount of control or influence, which could compromise the board's ability to effectively monitor financial reporting and the audit process. In addition, it has been suggested that the power of CEOs may encompass the ability to exert influence over the selection, continuation, or dismissal of external auditors (Turley and Zaman 2004). The presence of a CEO with substantial influence in this process could potentially impact the independence and objectivity of auditors (Goodwin and Yeo 2001; Stewart and Subramaniam 2010). This, in turn, may affect the thoroughness of the audit procedures and the overall quality of the audit opinion.

According to Han et al. (2016), CEOs who possess significant power inside an organization are likely to exert a greater impact on decision-making procedures, particularly in times of uncertainty. This effect may extend to areas such as financial reporting and audit activities. This means that the presence of significant CEO power has the potential to facilitate increased influence over the audit process, thereby affecting the thoroughness and impartiality of audits. Moreover, it is plausible that CEOs with a significant degree of authority may have a greater propensity for engaging in risk-taking behaviors, hence influencing the perception and handling of economic policy uncertainty inside the organization (Hoskisson et al. 2017). This heightened inclination towards risk could potentially influence the examination and methodology employed in audits and financial reporting. Moreover, the power of the CEO frequently establishes the prevailing ethos within an organization (Liu and Nguyen 2020; Garrett et al. 2022). The views of a CEO with significant influence can permeate across an organization, impacting the level of emphasis attributed to audit quality, particularly in times of economic uncertainty. Hence, drawing from prior arguments, it is anticipated that the influence of CEO authority could have a substantial amplifying effect on the repercussions for audit quality in times of economic uncertainty. This assumption may center on the extent to which CEOs possessing significant authority have heightened influence over decision-making procedures pertaining to financial reporting and audits during periods of uncertainty. The research findings may indicate a positive association between CEO power and its influence on the independence of audits, which could have implications for the trustworthiness and precision of financial disclosures.

Agency theory, developed by Jensen and Meckling (1979), highlights the intrinsic conflicts of interest between principals (shareholders) and agents (managers), exacerbated by information asymmetry. In the context of economic uncertainty, these conflicts intensify as unpredictability heightens the risk of opportunistic behaviors by managers. The moderating effect of CEO power on the nexus between economic uncertainty and audit quality reflects this dynamic. Powerful CEOs can leverage their authority to ensure stringent financial reporting and higher audit quality, reducing agency costs and mitigating adverse effects. On the contrary, excessive CEO power might compromise audit independence and diminish board oversight, leading to actions misaligned with shareholders' interests. It suggests that the impact of CEO power on audit quality during uncertain economic times

hinges on governance mechanisms and the CEO's ethical orientation. Strong corporate governance can harness CEO power positively, enhancing audit quality and mitigating risks, thus safeguarding shareholder interests. As a result, our second hypothesis is formulated as follows.

H2: *CEO power moderates the impact of economic uncertainty on audit quality.*

3. Data and Methodology

3.1. Sample Selection

This study utilizes data from publicly traded companies listed on stock markets in BRICS countries, covering the period from 1995 to 2022. The unavailability of consistent and reliable data for periods before 1995 and after 2022 justifies the selection of the timeframe from 1995 to 2022. Furthermore, we included only Brazil, Russia, India, China, and South Africa as members of the BRICS intergovernmental organization in our sample due to the unavailability of comprehensive data for the other BRICS nations. Therefore, out of the initial sample of 169,941 firm-year observations, we exclude 3326 observations pertaining to financial institutions and insurance, as well as 83,104 observations due to missing data that are used in the research. Table 1 provides a full description of the process employed for selecting the sample, resulting in a final sample size of 83,511 firm-year observations that are utilized for subsequent study. In order to minimize the influence of outliers, we applied the winsorization technique to all variables, setting the threshold at the 1% level for both the upper and lower tails of their respective distributions.

Table 1. Sample construction.

Selection Criterion	Observations Lost	Remaining Observations
Firm-year observations during 1995–2022		169,941
Non missing firm-year observations	(83,104)	86,837
Nonfinancial institutions and insurances	(3326)	83,511

3.2. Measurement of Variables

3.2.1. Audit Quality

Audit quality is a concept that is not easily measured or quantifiable. Consequently, scholars in the field have relied on several accounting measures as surrogate indicators for assessing audit quality (Knechel 2016). According to the findings of Rajgopal et al. (2021), the authors have categorized the 14 most commonly used proxies for measuring audit quality into two distinct groups: output-based proxies and input-based proxies. Output-based proxies encompass several indicators such as total accruals, restatements, small profits, and going concern opinions. Input-based and other proxies encompass a range of factors, such as big N auditors, the ratio of audit fees to total fees, client importance, auditor tenure, new client, client location, auditor-client location mismatch, city specialist auditors, and industry specialist auditors. In this context, we employ different indicators of audit quality by examining these two dimensions of audit quality, for which data are available from the EIKON DataStream database. In this study, we employ total accruals and restatements as output-based proxies to measure audit quality. Additionally, we utilize the audit-fees-to-total-fees ratio and auditor tenure as input-based proxies to assess audit quality.

Total accruals (TACC) are calculated as earnings before extraordinary items minus net cash flow from operations excluding extraordinary items and discontinued operations for a given firm year. Consistent with findings from the literature, total accruals are negatively associated with audit quality (Francis et al. 1999; DeFond and Zhang 2014).

Restatements (REST) is an indicator variable that equals 1 if the financial statements for the year are restated. Based on DeFond and Zhang (2014), Rajgopal et al. (2021), and John and Liu (2021), it is expected that auditors are more likely to violate auditing standards if their clients restate the financial statements.

The audit-fees-to-total-fees ratio (AFEE) is audit fees divided by the sum of audit fees and non-audit fees for a given firm year. Given the lack of consensus about the influence of the audit-fees-to-total-fees ratio on audit quality, we adopt the perspective that a high ratio positively impacts audit quality by ensuring auditor independence, focusing expertise on audit tasks, bolstering regulatory and public confidence, and reducing economic dependence on non-audit services (Reynolds et al. 2004; Hoitash et al. 2007; DeFond and Zhang 2014; Rajgopal et al. 2021; John and Liu 2021). This implies that when the ratio increases, the auditor's level of independence also increases.

Auditor tenure (AUTE) is the number of years the current auditor has been serving the organization for a given firm year. Given the absence of unanimous agreement on the impact of auditor tenure on audit quality, we rely on the research conducted by Ghosh and Moon (2005), Chen et al. (2008), and Manry et al. (2008), which posits that extended auditor-client relationships may enhance auditor independence, thereby improving audit quality.

3.2.2. Economic Uncertainty

In this study, we follow Anser et al. (2021), Wang et al. (2021), Chu et al. (2023), Shabir et al. (2023), and Li et al. (2023b) in order to measure economic uncertainty (ECUN). Therefore, we use the World Uncertainty Index that Ahir et al. (2022) proposed as a stand-in for ECUN. The quantification of uncertainty is achieved by counting the frequencies of the term “uncertainty” within the nation reports published by the Economist Intelligence Unit (EIU). These reports encompass an analysis of the economic and political developments in each country, as well as estimates pertaining to future policies and economic trends (Bilgin et al. 2021; Shabir et al. 2023). ECUN is reported on a quarterly basis. We used the Demir and Danisman (2021) and Shabir et al. (2023) methodology, which involves averaging the four quarterly values for a specific country-year of ECUN created by Ahir et al. (2022), to establish an annual ECUN measure.

3.2.3. CEO Power

Shabir et al. (2023) assert that a consensus over the definition of CEO power has not been reached in earlier scholarly works. Prior research has extensively utilized the four sources of CEO power as outlined by Finkelstein (1992), which encompass structural power, ownership power, expert power, and prestige power. Nevertheless, this particular definition does not readily align with the concept of inherent and unambiguous CEO dominance, as noted by Luo (2015). Thus, the present study adopts the methodology employed by Jiraporn et al. (2012), Luo (2015), Chao et al. (2017), and Shabir et al. (2023) to develop a CEO power index (CEOP). This index incorporates five variables that are associated with CEO power: title, founder, ownership, compensation pay slice, and tenure.

To measure CEO title, we use the variable CEO duality (CEOD). CEOD is an indicator variable that equals 1 if the CEO serves as board chair for a given firm year. Prior research has indicated that when the CEO simultaneously holds the position of board chair, they tend to possess greater power and influence within the organizational structure. The presence of CEO-chair duality has been found to impede the dissemination of information to other members of the board, diminishing the board's ability to exercise independent supervision over a manager (Jensen 1993).

CEO founder (CEOF) is an indicator variable that equals 1 if the CEO is one of the firm's founders for a given firm year. Prior research has indicated that CEOs who are also founders of the company tend to possess greater influence in the process of making funding decisions. According to Fischer and Pollock (2004), organizations headed by founder-CEOs may experience lower agency costs due to the founder's enhanced capacity to steer the organization, resulting in reduced internal conflicts.

CEO ownership (CEOO) is an indicator variable that equals 1 if the percentage of equity ownership held by the CEO is greater than or equal to 10% for a given firm year. Prior research has indicated that a greater level of CEO ownership inside a firm frequently exerts substantial sway over the decision-making processes related to finance. The aug-

mented ownership structure serves to align the CEO's incentives with the objectives of shareholders, thereby promoting an emphasis on the generation of long-term value (Pathan 2009; Chao et al. 2017).

The CEO compensation slice (CEOC) is the total compensation the CEO received divided by the combined total compensation of the top five executives (including the CEO) for a given firm year. The concept of CEOC has been recognized as a more straightforward method for assessing the level of CEO influence, as supported by previous studies (Bebchuk et al. 2011; Jiraporn et al. 2012; Chintrakarn et al. 2014).

CEO tenure (CEOT) is the total length of the CEO's tenure for a given firm year. According to existing research, a CEO's tenure lengthens with an increase in the level of authority they exercise (Zheng 2010; Altunbas et al. 2022).

In accordance with the studies conducted by Chao et al. (2017) and Shabir et al. (2023), the CEOP is developed through the utilization of Principal Component Analysis (PCA) to amalgamate the aforementioned five different variables into a single-dimensional index. An increase in CEOP is associated with an increase in CEO power.

3.2.4. Control Variables

In addition to economic policy uncertainty and CEO power, other factors that affect firms' audit quality can be grouped by firm-specific and country-specific characteristics. Therefore, in this study, the firm-specific characteristics that we employ are firm size, cash flow from operations, leverage, profitability, firm loss, firm complexity, inherent risk, and quick ratio (Sarhan et al. 2019; Alzeban 2020; El-Dyasty and Elamer 2020). In addition, the country-specific characteristics that we employ are the national governance index, inflation, market capitalization, and national culture values (power distance index and individualism) (Beisland et al. 2015; Bik and Hooghiemstra 2017; Gunn et al. 2019; Sarhan et al. 2019).

A detailed explanation of the variables and their respective sources is presented in Appendix A.

3.3. Econometric Model

To analyze the effect of economic uncertainty on audit quality, we constructed our baseline models, which are estimated as follows:

$$AFEE_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 X_{it} + \beta_3 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (1)$$

$$AUTE_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 X_{it} + \beta_3 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (2)$$

$$REST_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 X_{it} + \beta_3 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (3)$$

$$TACC_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 X_{it} + \beta_3 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (4)$$

where subscripts i , j , and t denote firms, countries, and time, respectively. $AFEE_{it}$, $AUTE_{it}$, $REST_{it}$, and $TACC_{it}$ are proxies for the audit quality as to the dependent variables. $ECUN_{jt}$ is our main independent variable. The vector X_{it} contains firm-level control variables, and Ψ_{jt} is a vector of country-level variables. α_0 is the intercept, β_1 , β_2 , and β_3 are the estimated coefficients, μ_j and ρ_t are the country and time-specific effects, and ε_{it} is the error term. We estimate all the above equations with the fixed-effects model and standard error clustered at the firm level. We also use alternative econometric methodologies and proxies for dependent and independent variables and other sensitivity tests later to confirm the robustness of our results.

Additionally, we also observe the moderating role of CEO power on the nexus between economic uncertainty and audit quality. Therefore, we extend our baseline models (1 to 4) by including the interaction term of our moderator ($CEOP_{it}$) with $ECUN_{jt}$. Then, the above models are constructed as follows:

$$AFEE_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 CEOP_{it} + \beta_3 ECUN_{jt} * CEOP_{it} + \beta_4 X_{it} + \beta_5 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (5)$$

$$AUTE_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 CEOP_{it} + \beta_3 ECUN_{jt} * CEOP_{it} + \beta_4 X_{it} + \beta_5 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (6)$$

$$REST_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 CEOP_{it} + \beta_3 ECUN_{jt} * CEOP_{it} + \beta_4 X_{it} + \beta_5 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (7)$$

$$TACC_{it} = \alpha_0 + \beta_1 ECUN_{jt} + \beta_2 CEOP_{it} + \beta_3 ECUN_{jt} * CEOP_{it} + \beta_4 X_{it} + \beta_5 \Psi_{jt} + \mu_j + \rho_t + \varepsilon_{it} \quad (8)$$

where $CEOP_{it}$ is a proxy for CEO power as the moderator variable, while $ECUN_{jt} * CEOP_{it}$ is the cross-product of the moderator variable with our primary independent variable of economic uncertainty.

4. Results and Discussion

4.1. Theoretical Framework and Research Questions

This study is grounded in agency theory, which posits that conflicts of interest between principals (shareholders) and agents (CEOs) are exacerbated by information asymmetry. Economic uncertainty further intensifies these conflicts, making it challenging for auditors to gather complete and accurate information, thus potentially affecting audit quality. We examine how economic uncertainty impacts audit quality and whether CEO power moderates this relationship. Therefore, the research questions we explore are: (a) How does economic uncertainty impact audit quality in BRICS countries? and (b) Does CEO power moderate the relationship between economic uncertainty and audit quality in BRICS countries?

4.2. Descriptive Statistics

Table 2 reports the descriptive statistics of the variables used in the regression. TACC exhibits a mean value of 9.311 and a standard deviation of 0.712. The observed values span a range from 7.645 to 11.405. This observation suggests that there is a very narrow range of values clustered closely around the average. REST displays a mean value that is very close to zero and a standard deviation of 0.011. The AFEE data have a mean of 0.399 and a standard deviation of 0.589, with values ranging from 0 to 2.276. The extensive range and slightly elevated standard deviation indicate significant diversity in this percentage among various firms. The mean duration of AUTE is 5.761 years, with a standard deviation of 3.466 years. The observed range spans from 1 to 17.346 years, suggesting considerable dispersion in auditor tenure among various firms. The variable ECUN exhibits a mean value of 0.176 and a standard deviation of 0.133. The observed values span a range from 0 to 0.636, indicating a considerable degree of fluctuation in economic uncertainty. CEOP has an average value of -0.004 and a standard deviation of 0.974. The observed range of CEOP, spanning from -1.720 to 2.834, signifies significant variations in the amounts of power held by CEOs among different firms.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
AFEE	83,511	0.399	0.589	0.000	2.276
AUTE	83,511	5.761	3.466	1.000	17.346
CAFL	83,511	8.179	0.780	6.201	10.416
CEOP	83,511	-0.004	0.974	-1.720	2.834
ECUN	83,511	0.176	0.133	0.000	0.636
FICO	83,511	0.735	0.572	0.022	3.614
FILO	83,511	0.123	0.329	0.000	1.000
FISI	83,511	9.411	0.694	7.798	11.474
INDI	83,511	42.447	3.384	24.000	46.000
INFL	83,511	3.239	2.984	-0.773	15.534
INRI	83,511	19.208	13.919	0.481	65.157
LEVE	83,511	0.487	0.241	0.056	1.389

Table 2. *Cont.*

Variable	Obs	Mean	Std. Dev.	Min	Max
MACA	83,511	1.732	0.164	1.244	2.100
NGIN	83,511	−0.450	0.187	−0.803	0.132
PODI	83,511	80.507	5.265	69.000	93.000
QUIC	83,511	1.524	1.965	0.093	13.760
REST	83,511	0.000	0.011	0.000	1.000
ROA	83,511	0.047	0.087	−0.351	0.301
TACC	83,511	9.311	0.712	7.645	11.405

Descriptive statistics of the variables employed in the present study. A detailed explanation of the variables and their respective sources is presented in Appendix A.

4.3. Economic Uncertainty and Audit Quality

Table 3 reports the effects of economic uncertainty on audit quality. Panels A and B show the impact of economic uncertainty on input-based proxies of audit quality (audit-fees-to-total-fees ratio and auditor tenure), while Panels C and D present the results of economic uncertainty on output-based proxies of audit quality (restatements and total accruals). In addition, Column 1 displays the outcome of our baseline equations (1 to 4) without the inclusion of control variables. Still, we control the country and time effects to examine the influence of economic uncertainty on audit quality. In Column 2, we incorporate the firm-specific control variables, whereas in Column 3, we consider the country-specific control variables. Column 4 incorporates a combination of control factors that pertain to both the firm and the specific country. The Durbin-Watson test is used to assess the presence of autocorrelation among the variables under testing. The Durbin-Watson values in all panels are between 1.5 and 2.5, which provide evidence of no auto-correlation among the variables. Furthermore, the Wald test is employed to assess the statistical significance of individual coefficients within a model. The results from all panels, where the *p*-value is 0, indicate that the observed effect is extremely statistically significant. The Jarque-Bera test is also employed to assess the hypothesis that a given sample is drawn from a normally distributed population. Thus, the Jarque-Bera test conducted on all panels in Table 3 indicates that the data meet the criteria for normality.

The estimated coefficients of ECUN on TACC and REST exhibit a positive and statistically significant relationship, whereas the estimated coefficients of ECUN on AFEE and AUTE demonstrate a negative and statistically significant relationship. The findings indicate that heightened economic uncertainty has a detrimental impact on audit quality. These results show that an increase in economic uncertainty deteriorates audit quality, as indicated by increased total accruals and restatements and decreased audit-fees-to-total-fees ratio and auditor tenure, which is consistent with the previous literature by Zhang et al. (2018), Al-Thaqeb and Algharabali (2019), Tessema (2020), and Lee and Jeong (2023). According to research by Tessema (2020) and Lee and Jeong (2023), economic uncertainty exacerbates information asymmetry, making it challenging for auditors to gather complete and accurate information. This may result in auditors relying on biased or incomplete data provided by the client. This hampers the process of evaluating risks, conducting verification procedures, and detecting financial manipulations, thus undermining the trustworthiness of audits.

These relationships suggest that heightened economic uncertainty increases agency problems, as managers may exploit the complexity to manipulate earnings, and auditors face more challenges in providing high-quality audits. The results align with agency theory, which posits that information asymmetry and conflicting interests between managers and auditors worsen under uncertain conditions, leading to decreased audit quality. From an economic perspective, these findings indicate that increased economic uncertainty can degrade the quality of financial reporting, potentially affecting investor confidence and market stability. From an academic perspective, the results underscore the importance of understanding how macroeconomic factors like uncertainty influence audit practices and outcomes, providing a basis for further research into mitigating these effects. From a policy perspective, regulators may need to enforce stricter auditing standards and provide

additional guidance during periods of high economic uncertainty to ensure the reliability of financial reporting and protect stakeholders' interests.

Additionally, based on the rise in audit fees and audit hours, our findings imply that auditors need higher compensation to account for the increased audit risks during periods of economic uncertainty. This is because the heightened complexity and potential hazards associated with auditing in these time frames can also impact the auditors' ability to perform comprehensive and unbiased audits. We also can see that auditors reduce their fees in response to increased economic uncertainty, which is consistent with research by Zhang et al. (2018). Given market pressures, it is possible to interpret this decrease in fees as a potential decline in the audit's level of effort or quality. In summary, our results confirm H1.

Table 3 provides further evidence of a strong relationship between both types of control variables (firm-specific and country-specific) and audit quality, which is consistent with Sarhan et al. (2019), Alzeban (2020), and El-Dyasty and Elamer (2020). The initial set of control variables (firm-specific variables) demonstrates that companies with higher cash flow from operations, greater size, and higher inherent risk exhibit a propensity for higher-quality audits. This is likely attributed to a combination of increased resources, higher stakes, and the necessity for more stringent auditing in intricate and risk-prone settings. On the contrary, our results suggest that firm complexity, firm loss, leverage, quick ratio, and profitability are linked to lower audit quality, indicating that firms that are more complex, financially distressed, highly leveraged, less liquid, and less profitable may encounter difficulties in ensuring high-quality audits. These factors might complicate the audit procedure, perhaps resulting in diminished meticulousness and precision when evaluating a company's financial well-being and adherence to regulations.

Table 3. The effect of economic uncertainty on audit quality.

Variable	(1)	(2)	(3)	(4)
Panel A: Audit-fees-to-total-fees ratio (AFEE)				
Constant	0.445 *** (131.666)	0.353 *** (11.711)	−0.155 ** (−3.222)	0.013 (0.249)
ECUN	−0.261 *** (−17.059)	−0.276 *** (−17.585)	−0.227 *** (−12.877)	−0.236 *** (−13.314)
CAFL		−0.056 *** (−12.668)		−0.043 *** (−9.876)
FICO		0.033 *** (8.597)		0.043 *** (10.846)
FILO		0.018 ** (2.297)		0.003 (0.405)
FISI		−0.068 *** (−13.736)		−0.063 *** (−12.569)
INRI		−0.001 *** (−7.449)		−0.001 *** (−8.834)
LEVE		0.246 *** (22.776)		0.240 *** (21.712)
QUIC		0.004 *** (3.486)		0.003 *** (2.895)
ROA		0.167 *** (5.000)		0.209 *** (6.263)
INDI			0.012 *** (13.020)	0.012 *** (13.077)
INFL			−0.000 (−1.140)	−0.001 (−1.552)
MACA			0.379 *** (27.213)	0.357 *** (25.529)
NGIN			−0.240 *** (−11.976)	−0.302 *** (−14.747)
PODI			−0.008 *** (−11.450)	−0.012 *** (−16.024)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.346	0.336	0.360	0.324
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	1.711	1.716	1.720	1.723

Table 3. Cont.

Variable	(1)	(2)	(3)	(4)
Panel B: Auditor tenure (AUTE)				
Constant	6.226 *** (314.270)	6.018 *** (33.955)	1.550 *** (5.505)	2.094 *** (6.842)
ECUN	−2.637 *** (−29.392)	−2.643 *** (−28.638)	−1.386 *** (−13.470)	−1.380 *** (−13.269)
CAFL		−0.173 *** (−6.646)		−0.096 *** (−3.706)
FICO		0.066 ** (2.912)		0.054 ** (2.330)
FILO		0.240 *** (5.009)		0.118 ** (2.475)
FISI		−0.234 *** (−8.002)		−0.090 ** (−3.057)
INRI		−0.000 (−0.548)		−0.002 ** (−2.850)
LEVE		0.832 *** (13.072)		0.510 *** (7.866)
QUIC		0.029 *** (4.208)		0.013 * (1.967)
ROA		0.840 *** (4.275)		0.784 *** (4.011)
INDI			0.038 *** (6.854)	0.031 *** (5.598)
INFL			−0.113 *** (−23.741)	−0.106 *** (−22.044)
MACA			1.134 *** (13.960)	1.095 *** (13.363)
NGIN			−1.948 *** (−16.621)	−2.005 *** (−16.743)
PODI			0.004 (1.028)	0.005 (1.215)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.310	0.314	0.327	0.343
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	2.245	2.246	0.247	0.246
Panel C: Restatements (REST)				
Constant	−0.000 (−1.028)	−0.003 *** (−6.365)	0.002 * (2.383)	−0.000 (−0.007)
ECUN	0.001 *** (3.903)	0.000 ** (2.843)	0.001 *** (3.730)	0.001 ** (3.070)
CAFL		0.000 (0.990)		0.000 (0.781)
FICO		−0.000 (−0.300)		−0.000 (−0.147)
FILO		−0.000 (−0.602)		−0.000 (−0.724)
FISI		0.000 *** (3.476)		0.000 *** (4.467)
INRI		−0.000 (−1.224)		−0.000 (−0.159)
LEVE		−0.000 (−0.695)		−0.000 * (−2.052)
QUIC		−0.000 (−0.760)		−0.000 (−0.931)
ROA		−0.000 (−0.322)		−0.000 (−0.239)
INDI			0.000 (0.900)	0.000 (0.401)
INFL			0.000 *** (5.069)	0.000 *** (5.638)
MACA			−0.000 * (−1.927)	−0.000 ** (−2.456)
NGIN			0.000 (1.638)	0.001 ** (2.537)
PODI			0.000 ** (2.276)	0.000 *** (4.123)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.317	0.380	0.364	0.314
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	1.834	1.835	1.834	1.836

Table 3. Cont.

Variable	(1)	(2)	(3)	(4)
Panel D: Total accruals (TACC)				
Constant	9.156 *** (268.113)	−0.049 *** (−7.774)	5.494 *** (98.319)	−0.058 *** (−5.337)
ECUN	0.875 *** (47.881)	0.021 *** (6.395)	0.577 *** (28.256)	0.014 *** (3.989)
CAFL		0.017 *** (19.198)		0.015 *** (16.419)
FICO		−0.000 (−0.792)		−0.007 *** (−9.126)
FILO		0.001 (1.065)		−0.004 ** (−2.779)
FISI		0.982 *** (937.109)		0.979 *** (919.431)
INRI		0.001 *** (36.787)		0.001 *** (33.682)
LEVE		−0.021 *** (−9.543)		−0.020 *** (−8.903)
QUIC		−0.030 *** (−118.550)		−0.030 *** (−120.693)
ROA		−0.093 *** (−13.359)		−0.098 *** (−14.119)
INDI			−0.026 *** (−24.412)	−0.005 *** (−26.396)
INFL			0.011 *** (12.299)	0.000 ** (3.191)
MACA			−0.111 *** (−6.890)	−0.032 *** (−11.099)
NGIN			0.708 *** (30.447)	0.020 *** (4.835)
PODI			0.062 *** (71.609)	0.004 *** (26.669)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.967	0.970	0.984	0.970
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	0.220	0.216	0.209	0.596

This table shows the outcomes of our baseline regression models (1) to (4) regarding the impact of economic uncertainty on audit quality. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The independent variable under consideration in this study is economic uncertainty (ECUN). Panel A represents the result of ECUN on AFEE. Panel B represents the result of ECUN on AUTE. Panel C represents the result of ECUN on REST. Panel D represents the result of ECUN on TACC. The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

Regarding control variables, the results in Table 3 imply that in environments with a strong focus on individual achievements and in larger companies with higher market values, there might be factors that adversely affect the quality of financial audits, consistent with Bik and Hooghiemstra (2017) and Gunn et al. (2019). This could be due to a combination of increased complexity, potential conflicts of interest, and the influence of personal discretion over standardized practices. On the contrary, inflation, the national governance index, and the power distance index are positively associated with audit quality, consistent with Beisland et al. (2015) and Sarhan et al. (2019), indicating that under certain economic, cultural, and governance conditions, the standards, thoroughness, and effectiveness of audits are likely to be higher, ensuring more reliable and accurate financial reporting.

4.4. The Role of CEO Power

We are interested in investigating if the impact of economic uncertainty on audit quality differs among organizations depending on the level of CEO power and whether it neutralizes the effects of economic uncertainty on audit quality. For this purpose, we conduct different estimations of regressions (Equations (5)–(8)). In our analysis, we incorporate an interaction term between the CEO power index variable and economic uncertainty. The findings of this analysis are presented in Table 4. The coefficients of the interaction terms in these estimates demonstrate the conditional impact of CEO power on audit qual-

ity. In particular, Panels A and B demonstrate how CEO power affects the relationship between economic uncertainty and input-based measures of audit quality (such as the ratio of audit fees to total fees and auditor tenure). On the other hand, Panels C and D provide findings regarding how CEO power affects the relationship between economic uncertainty and output-based measures of audit quality (such as restatements and total accruals). Furthermore, Column 1 exhibits the results of our Equations (5)–(8) without the incorporation of control variables. However, we manipulate the variables of country and time in order to analyze the CEO's power as a moderator in the relationship between economic uncertainty and audit quality. In Column 2, we include the firm-specific control variables, whereas in Column 3, we take into account the country-specific control variables. Column 4 encompasses a blend of control variables that relate to both the firm and the specific country. The Durbin-Watson test indicates the absence of any autocorrelation among the variables. The Wald test confirms that the observed effect is highly statistically significant. The Jarque-Bera test confirms that the data satisfy the conditions for normality.

In order to assess the CEO's ability to exercise decision-making power in a more complete manner, we have created a CEO power index (CEOP). This index is constructed using Principal Component Analysis, which takes into account five variables linked to CEO power: CEO duality, CEO-founder status, CEO ownership, CEO compensation slice, and CEO tenure. The results presented in Panels A and B of Table 4 indicate that the coefficients of the CEO power index and its interaction terms with economic uncertainty are significantly positive. Conversely, the results are presented in Panels C and D of Table 4 indicate that the coefficients of the CEO power index and its interaction terms with economic uncertainty are significantly negative. This suggests that power enables the CEO to effectively implement strategies, leading to increased audit quality.

Table 4. The effect of economic uncertainty on audit quality: The role of CEO power.

Variable	(1)	(2)	(3)	(4)
Panel A: Audit-fees-to-total-fees ratio (AFEE)				
Constant	0.449 *** (131.850)	0.415 *** (13.596)	−0.028 (−0.586)	0.186 *** (3.515)
ECUN	−0.276 *** (−17.750)	−0.297 *** (−18.644)	−0.273 *** (−15.148)	−0.289 *** (−15.928)
CEOP	0.035 *** (8.922)	0.034 *** (8.574)	0.064 *** (15.201)	0.066 *** (15.723)
ECUN*CEOP	0.081 *** (4.906)	0.043 *** (2.602)	0.022 *** (1.335)	0.000 * (0.058)
CAFL		−0.058 *** (−13.233)		−0.045 *** (−10.356)
FICO		0.025 *** (6.574)		0.038 *** (9.672)
FILO		0.024 *** (3.017)		0.004 (0.583)
FISI		−0.065 *** (−13.146)		−0.062 *** (−12.392)
INRI		−0.001 *** (−7.545)		−0.001 *** (−9.908)
LEVE		0.253 *** (23.299)		0.262 *** (23.618)
QUIC		0.004 *** (3.712)		0.003 *** (3.086)
ROA		0.165 *** (4.950)		0.194 *** (5.831)
INDI			0.018 *** (18.730)	0.019 *** (19.203)
INFL			−0.006 *** (−7.376)	−0.004 *** (−5.113)
MACA			0.425 *** (30.091)	0.408 *** (28.762)
NGIN			−0.249 *** (−12.307)	−0.309 *** (−15.012)
PODI			−0.014 *** (−17.859)	−0.018 *** (−22.437)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.146	0.153	0.224	0.324
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	0.212	0.176	0.225	0.288

Table 4. Cont.

Variable	(1)	(2)	(3)	(4)
Panel B: Auditor tenure (AUTE)				
Constant	6.216 *** (311.047)	6.000 *** (33.394)	2.114 *** (7.363)	2.686 *** (8.614)
ECUN	−2.466 *** (−26.999)	−2.522 *** (−26.925)	−1.259 *** (−11.945)	−1.273 *** (−11.954)
CEOP	0.127 *** (5.410)	0.129 *** (5.449)	0.242 *** (9.798)	0.245 *** (9.880)
ECUN*CEOP	0.948 *** (9.779)	0.807 *** (8.300)	0.910 *** (9.206)	0.850 *** (8.591)
CAFL		−0.168 *** (−6.438)		−0.096 *** (−3.729)
FICO		0.051 ** (2.227)		0.057 ** (2.451)
FILO		0.234 *** (4.875)		0.119 ** (2.497)
FISI		−0.227 *** (−7.738)		−0.085 *** (−2.863)
INRI		−0.000 (−0.905)		−0.002 *** (−2.749)
LEVE		0.772 *** (12.062)		0.503 *** (7.733)
QUIC		0.027 *** (3.881)		0.012 * (1.750)
ROA		0.814 *** (4.143)		0.736 *** (3.767)
INDI			0.043 *** (7.557)	0.038 *** (6.598)
INFL			−0.115 *** (−23.297)	−0.110 *** (−22.060)
MACA			1.097 *** (13.285)	1.073 *** (12.900)
NGIN			−2.125 *** (−17.910)	−2.165 *** (−17.896)
PODI			−0.005 (−1.184)	−0.004 (−0.998)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.317	0.349	0.339	0.354
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	0.144	0.145	0.148	0.148
Panel C: Restatements (REST)				
Constant	−0.000 (−0.868)	−0.003 *** (−6.283)	0.001 * (1.951)	−0.000 (−0.442)
ECUN	0.001 *** (3.270)	0.000 ** (2.334)	0.001 *** (3.448)	0.001 * (2.795)
CEOP	−0.000 *** (−1.552)	−0.000 ** (−2.259)	−0.000 * (−1.953)	−0.000 ** (−2.254)
ECUN*CEOP	−0.001 ** (−2.871)	−0.001 *** (−3.224)	−0.000 * (−1.693)	−0.000 * (−1.874)
CAFL		0.000 (0.923)		0.000 (0.789)
FICO		−0.000 (−0.089)		−0.000 (−0.113)
FILO		−0.000 (−0.634)		−0.000 (−0.718)
FISI		0.000 *** (3.579)		0.000 *** (4.510)
INRI		0.000 (1.089)		0.000 (0.187)
LEVE		−0.000 (−1.033)		−0.000 ** (−2.054)
QUIC		−0.000 (−0.879)		−0.000 (−0.977)
ROA		−0.000 (−0.270)		−0.000 (−0.183)
INDI			−0.000 (−0.629)	−0.000 (−1.057)
INFL			0.000 *** (5.025)	0.000 *** (5.651)
MACA			−0.001 * (−1.849)	−0.001 ** (−2.383)
NGIN			0.001 (1.342)	0.001 ** (2.218)
PODI			0.000 * (1.693)	0.000 *** (3.432)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.152	0.191	0.166	0.147
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	1.855	1.835	1.834	1.836

Table 4. Cont.

Variable	(1)	(2)	(3)	(4)
Panel D: Total accruals (TACC)				
Constant	9.180 *** (277.588)	−0.025 *** (−3.982)	5.628 *** (98.985)	−0.058 *** (−5.231)
ECUN	0.770 *** (41.812)	0.007 ** (2.393)	0.534 *** (0.020)	0.009 ** (2.371)
CEOP	−0.150 *** (−31.596)	−0.007 *** (8.259)	−0.067 *** (−13.654)	−0.000 *** (0.396)
ECUN*CEOP	−0.222 *** (−11.372)	−0.020 *** (5.838)	−0.038 *** (−1.969)	−0.017 *** (−4.853)
CAFL		0.016 *** (17.987)		0.015 *** (16.286)
FICO		−0.004 *** (−4.958)		−0.007 *** (−9.448)
FILO		−0.000 (−0.363)		−0.004 ** (−2.826)
FISI		0.981 *** (938.312)		0.979 *** (919.585)
INRI		0.001 *** (37.514)		0.001 *** (33.953)
LEVE		−0.027 *** (−11.833)		−0.022 *** (−9.560)
QUIC		−0.030 *** (−119.709)		−0.030 *** (−120.859)
ROA		−0.094 *** (−13.480)		−0.098 *** (−14.108)
INDI			−0.020 *** (−18.377)	−0.005 *** (−24.061)
INFL			0.016 *** (17.145)	0.000 (1.334)
MACA			−0.155 *** (−9.488)	−0.028 *** (−9.608)
NGIN			0.696 *** (29.632)	0.023 *** (5.413)
PODI			0.056 *** (62.237)	0.004 *** (24.444)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.848	0.970	0.902	0.970
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	0.222	0.188	0.212	0.196

This table shows the outcomes of our regression models (5) to (8) regarding the moderating role of CEO power in the relationship between economic uncertainty and audit quality. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The independent variable under consideration in this study is economic uncertainty (ECUN). The moderating variable under consideration in this study is CEO power (CEOP). Panel A represents the result of CEOP on the ECUN-AFEE nexus. Panel B represents the result of CEOP on the ECUN-AUTE nexus. Panel C represents the result of CEOP on the ECUN-REST nexus. Panel D represents the result of CEOP on the ECUN-TACC nexus. The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

Regarding the impact of CEO power on audit quality, Panels A and B in Table 4 indicate a positive correlation between CEOP and AFEE as well as AUTE. In contrast, Panels C and D of Table 4 indicate a negative correlation between CEOP and REST as well as TACC, implying that while strong CEOs can reduce certain audit issues, they might manipulate financial information, affecting audit integrity. These findings are explained under the lens of agency theory, which examines conflicts between principals (shareholders) and agents (CEOs). From an economic perspective, the findings imply that powerful CEOs might increase audit costs (due to higher AFEE and AUTE) but also reduce financial misstatements (lower REST), which can affect company valuation and investor trust. From an academic perspective, this research expands the understanding of how CEO power influences audit quality, reinforcing theories by Ouyang et al. (2015) and Azizan (2019) about CEO dominance in financial reporting. From a policy perspective, the results suggest a need for regulations to limit CEO power over financial reporting and audits to maintain audit independence and integrity, ensuring accurate and reliable financial disclosures. Our findings concur with those of Ouyang et al. (2015) and Azizan (2019), which show that CEOs with significant power are more likely to have a substantial impact on financial reporting and audit processes. This influence can potentially impair the comprehensiveness and integrity

of audits. This impact encompasses the organization's guiding beliefs and places particular emphasis on audit quality. Furthermore, our research corroborates the conclusions reached by Bhandari et al. (2018) and Li (2019), indicating that a strong CEO has the ability to exercise significant power over financial reporting and disclosure processes, potentially impacting audit quality. This influence can have an impact on the management team, influencing the manipulation of financial information and compromising the independence of audits. Explained through the lens of agency theory, these findings highlight the conflicts between principals (shareholders) and agents (CEOs), illustrating how powerful CEOs can leverage their position to influence audit outcomes. Agency theory mechanisms suggest that while powerful CEOs may increase audit costs and demand more comprehensive audits, their ability to manipulate financial information underscores the need for stringent regulatory frameworks. In summary, our results confirm H2.

Regarding the impact of the interaction term ECUN*CEOP on the correlation between economic uncertainty and audit quality, Panels A and B of Table 4 indicate a positive relationship between ECUN*CEOP and AFEE—AUTE, while Panels C and D of Table 4 suggest a negative relationship between ECUN*CEOP and REST—TACC. This indicates that the power of the CEO has a major impact on the relationship between economic uncertainty and both input-based and output-based indicators of audit quality. In other terms, our findings indicate that CEO power intensifies the impact on audit quality at times of economic uncertainty, implying a positive correlation between CEO power and the meticulousness and independence of audits, which in turn influences the reliability and accuracy of financial disclosures. From the perspective of agency theory, our findings suggest that CEO power intensifies the impact on audit quality during times of economic uncertainty, implying a positive correlation between CEO power and the rigor and independence of audits, which in turn enhances the reliability and accuracy of financial disclosures. From an economic perspective, these findings underscore the importance of strong corporate governance structures to ensure high audit quality, particularly in uncertain economic periods, thereby boosting investor confidence and market stability. From a policy perspective, regulators might consider implementing stricter controls on CEO power to ensure unbiased and independent audits, thereby improving the transparency and accuracy of financial disclosures during economic uncertainty. In summary, our results confirm H2.

5. Robustness Checks

5.1. Alternative Audit Quality Measurement

We use going concern opinion (GOCO) as an alternative proxy for an input-based measure of audit quality. GOCO is an indicator variable that equals 1 if the auditor issues a going concern opinion for a given firm year. According to DeFond and Zhang (2014) and Rajgopal et al. (2021), going concern opinions signal low audit quality. In addition, we use audit industry specialists (AISP) as an alternative proxy for output-based measures of audit quality. AISP is an indicator variable that equals 1 if the auditor satisfies one of the two following definitions (Reichelt and Wang 2010; Rajgopal et al. 2021) for a given firm year: (1) an auditor is a city industry specialist if it has the largest annual market share in an industry, based on the two-digit SIC code, and if its annual market share is at least 10 percentage points greater than its closest competitor in a city audit market; or (2) if it has an annual market share greater than 50% in an industry, based on the two-digit SIC code in the city audit market. According to Rajgopal et al. (2021), firms with audit industry specialists signal high audit quality. The findings are presented in Table 5. The coefficients of ECUN exhibit a notable positive correlation with GOCO and a notable negative correlation with AISP, which aligns with the results shown in Table 3. These data suggest that an increase in economic uncertainty leads to a decrease in audit quality.

Table 5. Alternative measure of audit quality.

Variable	Dependent Variable: Going Concern Opinion (GOCO)	Dependent Variable: Audit Industry Specialist (AISP)
Constant	−0.095 *** (−12.295)	−0.019 (−0.531)
ECUN	0.024 *** (9.487)	−0.214 *** (−17.499)
CAFL	0.000 (0.584)	−0.001 (−0.427)
FICO	−0.003 *** (−6.373)	−0.005 ** (−2.043)
FILO	0.013 *** (11.495)	−0.016 ** (−2.943)
FISI	−0.005 *** (−7.248)	0.018 *** (5.377)
INRI	0.000 *** (2.921)	−0.000 *** (−3.711)
LEVE	0.022 *** (13.878)	−0.032 *** (−4.238)
QUIC	0.000 ** (2.477)	0.000 (0.806)
ROA	−0.031 *** (−6.350)	−0.224 *** (−9.775)
INDI	−0.001 *** (−7.803)	−0.012 *** (−18.662)
INFL	−0.000 ** (−2.937)	−0.020 *** (−36.108)
MACA	−0.017 *** (−8.250)	0.127 *** (13.186)
NGIN	0.012 *** (4.126)	−0.297 *** (−21.129)
PODI	0.002 *** (23.019)	0.009 *** (17.025)
Obs.	83,511	83,511
Country FE	YES	YES
Year FE	YES	YES
Adjusted R-squared	0.271	0.494
Wald test (<i>p</i> -value)	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000
Durbin-Watson test	0.247	0.104

This table shows the outcomes of our baseline regression models using alternative proxies of audit quality as dependent variables as robustness. The alternative dependent variables under consideration in this study are going concern opinion (GOCO) and audit industry specialist (AISP). The independent variable under consideration in this study is economic uncertainty (ECUN). The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

5.2. Alternative Economic Uncertainty Measurement

We adopt two additional approaches for ECUN that Demir and Danisman (2021) and Shabir et al. (2023) suggested in order to strengthen and improve the comparability of our results. These methods expand on the initial ECUN measure that Ahir et al. (2022) created. AlterECUN is measured as the weighted average of the quarterly country-specific ECUN with weights 1 and 2 for the first and last 6 months of a given country-year. AlterECUN1 is measured as the weighted average of the quarterly country-specific ECUN with weights 1 and 4 for each subsequent quarter of a given country-year. The estimated results based on these economic uncertainty metrics are presented in Table 6. The results align with the initial findings shown in Table 3, indicating that an increase in economic uncertainty has a negative impact on the quality of audits.

Table 6. Alternative measure of economic uncertainty.

Variable	Dependent Variable: Audit-Fees-to-Total-Fees Ratio (AFEE)		Dependent Variable: Auditor Tenure (AUTE)		Dependent Variable: Restatements (REST)		Dependent Variable: Total Accruals (TACC)	
Constant	0.024 (0.476)	0.053 (1.035)	2.187 *** (7.172)	2.329 *** (7.698)	−0.000 (−0.113)	−0.000 (−0.126)	−0.059 *** (−5.452)	−0.059 *** (−5.528)
AlterECUN	−0.218 *** (−13.292)		−1.241 *** (−12.888)		0.001 *** (2.822)		0.013 *** (3.861)	
AlterECUN1		−0.201 *** (−13.102)		−1.176 *** (−13.080)		0.001 *** (3.362)		0.014 *** (4.506)
CAFL	−0.043 *** (−9.822)	−0.043 *** (−9.820)	−0.094 *** (−3.654)	−0.094 *** (−3.650)	0.000 (0.770)	0.000 (0.767)	0.015 *** (16.403)	0.015 *** (16.400)
FICO	0.043 *** (10.839)	0.042 *** (10.772)	0.054 * (2.340)	0.055 ** (2.404)	−0.000 (−0.144)	−0.000 (−0.131)	−0.007 *** (−9.123)	−0.007 *** (−9.106)
FILO	0.003 (0.469)	0.004 (0.490)	0.122 ** (2.557)	0.122 ** (2.558)	−0.000 (−0.697)	−0.000 (−0.722)	−0.004 *** (−2.754)	−0.004 *** (−2.784)
FISI	−0.063 *** (−12.494)	−0.063 *** (−12.405)	−0.087 *** (−2.954)	−0.085 *** (−2.888)	0.000 *** (4.503)	0.000 *** (4.489)	0.979 *** (919.843)	0.979 *** (920.224)
INRI	−0.001 *** (−8.857)	−0.001 *** (−8.801)	−0.002 *** (−2.835)	−0.002 *** (−2.882)	0.000 (0.158)	0.000 (0.160)	0.001 *** (33.676)	0.001 *** (33.680)
LEVE	0.240 *** (21.724)	0.239 *** (21.611)	0.511 *** (7.878)	0.503 *** (7.767)	−0.000 ** (−2.049)	−0.000 ** (−2.078)	−0.020 *** (−8.899)	−0.020 *** (−8.938)
QUIC	0.003 ** (2.919)	0.003 *** (2.910)	0.014 * (2.014)	0.014 ** (1.980)	−0.000 (−0.910)	−0.000 (−0.950)	−0.030 *** (−120.690)	−0.030 *** (−120.730)
ROA	0.210 *** (6.290)	0.210 *** (6.310)	0.788 *** (4.031)	0.793 *** (4.059)	−0.000 (−0.241)	−0.000 (−0.257)	−0.098 *** (−14.113)	−0.098 *** (−14.092)
INDI	0.012 *** (12.781)	0.012 *** (12.650)	0.029 *** (5.285)	0.029 *** (5.164)	−0.000 (−1.480)	−0.000 (−1.498)	−0.005 *** (−26.325)	−0.005 *** (−26.306)
INFL	−0.001 (−1.500)	−0.001 (−1.326)	−0.107 *** (−22.180)	−0.107 *** (−22.328)	0.000 *** (5.700)	0.000 *** (5.644)	0.000 *** (3.233)	0.001 *** (3.164)
MACA	0.362 *** (25.802)	0.359 *** (25.596)	1.120 *** (13.626)	1.103 *** (13.445)	−0.000 *** (−2.498)	−0.001 ** (−2.515)	−0.032 *** (−11.153)	−0.032 *** (−11.184)
NGIN	−0.321 *** (−16.101)	−0.318 *** (−15.821)	−2.134 *** (−18.247)	−2.098 *** (−17.845)	0.0001 ** (2.297)	0.001 ** (2.504)	0.022 *** (5.286)	0.020 *** (4.985)
PODI	−0.013 *** (−16.351)	−0.013 *** (−16.583)	−0.004 (−0.893)	−0.003 (−0.740)	0.000 *** (4.039)	0.000 *** (4.070)	0.004 *** (26.847)	0.004 *** (26.871)
Obs.	83,511	83,511	83,511	83,511	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R-squared	0.248	0.247	0.342	0.342	0.142	0.146	0.970	0.971
Wald test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jarque-Bera test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Durbin-Watson test	0.241	0.223	0.147	0.146	1.836	1.836	0.196	0.196

This table shows the outcomes of our baseline regression models using alternative proxies of economic uncertainty as independent variables as robustness. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The alternative independent variables under consideration in this study are alternative economic uncertainty (AlterECUN) and alternative economic uncertainty (AlterECUN1). The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The t-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

5.3. Alternative CEO Power Measurement

The utilization of the standard PCA on dummy variables for the purpose of assessing the CEOP, as outlined in Section 3.2.3, has the potential to introduce estimation bias (Kolenikov and Angeles 2004). To tackle this matter, a discrete PCA is suggested. Incorporating both continuous and indicator variables into a discrete PCA can successfully address the issue of bias in the correlation matrix, according to research by Chao et al.

(2017). In this section, we use a strict method to obtain the first part of discrete PCA and then develop an alternative way to measure CEO power, which we call AlterCEOP. An increase in AlterCEOP is associated with an increase in CEO power. Table 7 presents the findings of the alternative CEO power. The statistical significance of the coefficients on the alternative CEO power index persists. These results once again validate the findings in Table 4, indicating a U-shaped correlation between the CEO power index and audit quality. In addition, in line with the observations presented in Table 4, the outcomes displayed in Table 7 indicate that the power of the CEO limits the detrimental effect of economic uncertainty on the quality of audits.

Table 7. Alternative measure of CEO power.

Variable	Dependent Variable: Audit-Fees-to-Total- Fees Ratio (AFEE)	Dependent Variable: Auditor Tenure (AUTE)	Dependent Variable: Restatements (REST)	Dependent Variable: Total Accruals (TACC)
Constant	−0.002 (−0.052)	1.893 *** (6.224)	−0.000 (−0.015)	−0.057 *** (−5.207)
ECUN	−0.236 *** (−13.290)	−1.369 *** (−13.242)	0.001 *** (3.067)	0.014 *** (3.984)
AlterCEOP	0.043 *** (11.947)	0.465 *** (22.024)	−0.000 *** (1.310)	−0.006 ** (−8.694)
ECUN*AlterCEOP	0.055 *** (−3.350)	0.380 *** (3.934)	−0.000 *** (−0.921)	−0.003 *** (4.394)
CAFL	−0.043 *** (−9.777)	−0.090 *** (−3.516)	0.000 (0.793)	0.015 *** (16.347)
FICO	0.045 *** (11.383)	0.030 (1.307)	−0.000 (−0.106)	−0.007 *** (−9.450)
FILO	0.004 (0.492)	0.126 ** (2.651)	−0.000 (−0.733)	−0.004 *** (−2.719)
FISI	−0.067 *** (−13.264)	−0.132 *** (−4.466)	0.000 *** (4.507)	0.978 *** (918.737)
INRI	−0.001 *** (−8.473)	−0.003 *** (−3.611)	0.000 (0.186)	0.001 *** (33.914)
LEVE	0.238 *** (21.519)	0.480 *** (7.450)	−0.000 ** (−2.040)	−0.020 *** (−9.024)
QUIC	0.003 *** (3.078)	0.016 ** (2.347)	−0.000 (−0.941)	−0.030 *** (−120.658)
ROA	0.219 *** (6.572)	0.885 *** (4.554)	−0.000 (−0.196)	−0.097 *** (−13.863)
INDI	0.013 *** (14.290)	0.044 *** (8.002)	−0.000 (−1.506)	−0.005 *** (−27.129)
INFL	−0.001 (−1.159)	−0.110 *** (−22.992)	0.000 *** (5.614)	0.001 *** (3.404)
MACA	0.352 *** (25.172)	1.040 *** (12.766)	−0.001 ** (−2.502)	−0.031 *** (−10.801)
NGIN	−0.309 *** (−15.138)	−2.090 *** (−17.561)	0.001 ** (2.570)	0.021 *** (5.084)
PODI	−0.013 *** (−17.028)	−0.003 (−0.744)	0.000 *** (4.202)	0.004 *** (27.281)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.279	0.465	0.143	0.970
Wald test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Jarque-Bera test (<i>p</i> -value)	0.000	0.000	0.000	0.000
Durbin-Watson test	0.234	0.247	1836	0.196

This table shows the outcomes of our baseline regression models using an alternative proxy of CEO power as a moderator variable for robustness. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The independent variable under consideration in this study is economic uncertainty (ECUN). The alternative moderate variable under consideration in this study is alternative CEO power (AlterCEOP). The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

5.4. Endogeneity

When analyzing the impact of economic uncertainty on audit quality, several endogeneity problems can arise, complicating the interpretation of results. Reverse causality is a key concern, as it's possible that poor audit quality might contribute to economic uncertainty rather than being a consequence of it. Measurement errors in quantifying economic uncertainty and audit quality can introduce biases, while omitted variables might influence both factors, leading to spurious correlations. Simultaneity problems, in which economic

uncertainty and audit quality are both influenced by other factors, can also skew results. Lastly, selection bias in the sample may skew results if these firms inherently have better audit practices. We currently employ alternate economic approaches to investigate these issues in order to determine whether our main findings would be influenced by different assumptions in the process of generating data. Hence, to address potential endogeneity, we use the methodologies proposed by Carmona et al. (2015), Kyriakou and Dimitras (2018), Guizani and Abdalkrim (2021), Ocaik (2022), and Shabir et al. (2023), specifically the two-stage least squares (2SLS) and two-stage System Generalized Method of Moments (System GMM).

First, we re-estimate our regressions by employing a 2SLS regression with an instrumental variables approach. Following Carmona et al. (2015) and Ocaik (2022), we employ the lagged first-order difference of ECUN as an independent variable. Table 8 reports the second-stage estimation results. We find that the coefficients of ECUN are statistically significant and still show the same signs as our previous estimates, which are presented in Table 3.

Table 8. Endogeneity test using two-stage least squares (2SLS).

Variable	Dependent Variable: Audit-Fees-to-Total- Fees Ratio (AFEE)	Dependent Variable: Auditor Tenure (AUTE)	Dependent Variable: Restatements (REST)	Dependent Variable: Total Accruals (TACC)
Constant	−0.149 ** (−2.333)	−0.441 (−1.177)	−0.001 (−0.442)	−0.028 ** (−2.142)
ECUN	−0.471 *** (−8.432)	−3.764 *** (−11.499)	0.001 * (1.719)	0.057 *** (4.941)
CAFL	−0.043 *** (−9.868)	−0.096 *** (−3.701)	0.000 (0.785)	0.015 *** (16.416)
FICO	0.043 *** (10.945)	0.049 ** (2.123)	−0.000 (−0.169)	−0.007 *** (−9.219)
FILO	0.002 (0.327)	0.056 (1.169)	−0.000 (−0.843)	−0.005 *** (−3.377)
FISI	−0.068 *** (−13.209)	−0.141 *** (−4.625)	0.000 *** (4.192)	0.978 *** (896.245)
INRI	−0.010 *** (−9.150)	−0.002 ** (−2.217)	0.000 (0.220)	0.001 *** (33.241)
LEVE	0.240 *** (21.670)	0.508 *** (7.809)	−0.000 ** (−2.056)	−0.020 *** (−8.913)
QUIC	0.002 * (1.991)	0.003 (0.452)	−0.000 (−1.063)	−0.030 *** (−119.102)
ROA	0.216 *** (6.464)	0.857 *** (4.368)	−0.000 (−0.276)	−0.097 *** (−13.905)
INDI	0.013 *** (13.586)	0.038 *** (6.689)	−0.000 (−1.267)	−0.005 *** (−26.654)
INFL	−0.003 *** (−3.567)	−0.085 *** (−15.133)	0.000 *** (4.484)	0.000 (0.817)
MACA	0.377 *** (25.636)	1.298 *** (15.030)	−0.000 ** (−2.577)	−0.036 *** (−11.743)
NGIN	−0.205 *** (−6.863)	−1.023 *** (−5.830)	0.001 ** (2.307)	0.003 (0.483)
PODI	−0.011 *** (−12.810)	−0.021 *** (−4.236)	0.000 *** (4.084)	0.004 *** (22.740)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.228	0.282	0.137	0.970
Durbin-Watson test (<i>p</i> -value)	0.029	0.061	0.036	0.059
Wu-Hausman test (<i>p</i> -value)	0.000	0.000	0.000	0.000

This table shows the outcomes of our baseline regression models using the two-stage least squares (2SLS) as robustness. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The independent variable under consideration in this study is economic uncertainty (ECUN). The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

Second, we apply the System GMM proposed by Blundell and Bond (1998), which is particularly well suited to overcome the inconsistency caused by endogeneity. Kyriakou and Dimitras (2018) and Guizani and Abdalkrim (2021) have used this approach in order to evaluate different aspects of audit quality and eliminate the endogeneity bias. It checks for important types of endogeneity, like unobserved heterogeneity, simultaneity, and dynamic

endogeneity. These are very important in complex econometric models where results can be skewed by many unobserved factors and relationships happening at the same time (Pham et al. 2021; Shabir et al. 2023). Furthermore, System GMM uses internal instruments that are based on a company's past data to specifically target endogeneity problems that come up from unobserved simultaneity and heterogeneity (Eugster 2020; Shabir et al. 2023). Additionally, System GMM improves conventional estimation techniques by incorporating extra assumptions and moment conditions, as seen in its application to examining audit characteristics. This results in a more thorough and robust analysis, as seen in the use of the Hansen J-statistic for testing overidentifying restrictions (Meah et al. 2021; Shabir et al. 2023). Table 9 reports our results using the System GMM approach. The coefficient of the lagged dependent variable remains significant, which verifies the persistence of lower audit quality from one year to the next. This finding is similar to the previous outcome, which is reported in Table 3, and shows that ECUN decreases audit quality. Additionally, Table 9 shows that the AR(2) and Hansen J statistics are not significant, indicating that there is no second-order autocorrelation among errors and that the overidentifying restrictions are valid.

Table 9. Endogeneity test using two-stage System Generalized Method of Moments (System GMM).

Variable	Dependent Variable: Audit-Fees-to-Total- Fees Ratio (AFEE)	Dependent Variable: Auditor Tenure (AUTE)	Dependent Variable: Restatements (REST)	Dependent Variable: Total Accruals (TACC)
Constant	0.365 *** (7.139)	5.943 *** (31.965)	0.000 (0.746)	6.654 *** (105.267)
ECUN	−0.002 *** (−1.382)	−0.039 ** (−2.164)	0.001 *** (4.083)	0.016 *** (1.569)
CAFL	−0.000 (−1.110)	−0.004 (−0.911)	0.000 * (1.842)	0.113 *** (37.754)
FICO	0.000 (0.164)	0.011 (1.436)	−0.000 (−0.255)	−0.018 *** (−4.456)
FILO	0.000 (1.216)	0.009 (1.215)	−0.000 (−0.009)	−0.004 (−1.053)
FISI	−0.001 ** (−2.162)	−0.014 * (−1.742)	0.000 *** (3.016)	0.145 *** (32.992)
INRI	−0.000 (−1.014)	−0.000 (−0.224)	0.000 (0.226)	0.001 *** (11.129)
LEVE	0.000 (0.199)	0.025 (1.366)	−0.000 * (−1.657)	−0.101 *** (−9.786)
QUIC	0.000 (0.444)	0.000 (0.142)	−0.000 (−0.868)	−0.008 *** (−8.903)
ROA	0.001 (0.494)	0.031 (0.886)	−0.000 (−0.269)	−0.310 *** (−15.159)
INDI	0.001 *** (4.494)	0.001 (0.456)	−0.000 (−0.363)	−0.010 *** (−7.703)
INFL	−0.000 (−1.466)	−0.001 * (−1.792)	0.000 (0.333)	0.007 *** (13.857)
MACA	0.000 (0.084)	0.015 (1.120)	−0.000 (−1.149)	−0.043 *** (−5.335)
NGIN	−0.001 (−0.664)	−0.153 *** (−4.899)	0.001 *** (2.910)	0.075 *** (4.399)
PODI	−0.000 *** (−4.758)	−0.000 (−0.015)	0.000 ** (2.335)	0.010 *** (9.483)
Obs.	83,511	83,511	83,511	83,511
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adjusted R-squared	0.991	0.966	0.776	0.778
AR(2) test (<i>p</i> -value)	0.150	0.196	0.182	0.135
Hansen J-statistic test (<i>p</i> -value)	0.418	0.316	0.384	0.388

This table shows the outcomes of our baseline regression models using the two-stage System Generalized Method of Moments (System GMM) as robustness. The dependent variables under consideration in this study are the audit-fees-to-total-fees ratio (AFEE), auditor tenure (AUTE), restatements (REST), and total accruals (TACC). The independent variable under consideration in this study is economic uncertainty (ECUN). The remaining control variables can be classified into two distinct categories: firm characteristics (cash flow from operations (CAFL), firm complexity (FICO), firm loss (FILO), firm size (FISI), inherent risk (INRI), leverage (LEVE), quick ratio (QUIC), and profitability (ROA)) and country conditions (individualism (INDI), inflation (INFL), market capitalization (MACA), national governance index (NGIN), and power distance index (PODI)). The fixed-effects estimator is employed for all estimations. The *t*-statistics are presented in brackets. The symbols ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. A detailed explanation of the variables and their respective sources is presented in Appendix A.

6. Implications

The research outlined in this manuscript holds significant practical implications for stakeholders, including firms, policymakers, regulatory authorities, standard setters, and investors, especially those involved in BRICS countries. For multinational firms and in-

vestors, understanding the evolving role of BRICS nations in the global economy is crucial for making informed strategic and investment decisions, given the substantial impact these countries have on global GDP. The varied implementation and influence of IFRS among BRICS states highlight the need for tailored financial reporting and compliance strategies to align with each country's regulatory framework. Additionally, the findings on audit quality in relation to different national auditing standards emphasize the importance of effectively managing these variations. Observations on the correlation between economic uncertainty, CEO power, and audit quality underscore the necessity of strong corporate governance practices to maintain the integrity and reliability of financial reporting, particularly during periods of economic uncertainty. Policymakers can utilize these insights to develop strategies that enhance audit quality and ensure more reliable financial reporting and market stability.

From an academic perspective, this study makes significant contributions to multiple fields of research. An in-depth examination of the BRICS nations' contribution to the global economy provides a fresh outlook for economic studies, emphasizing the shift towards these emerging economies and their impact on global economic patterns. This is particularly relevant for research focused on international economics and market dynamics. The implementation of IFRS in BRICS nations presents valuable opportunities for studying international accounting practices and their effects on financial transparency and comparability. Furthermore, the diversity in auditing standards and practices across different nations offers a unique opportunity for comparative research on auditing and regulatory compliance. Exploring the impact of economic uncertainty on company operations opens new avenues for research in business strategy and risk management. The relationship between CEO power and audit quality, especially in the context of economic uncertainty, offers new perspectives on corporate governance and the dynamics of executive power in influencing financial reporting and auditing. Overall, this research enhances the understanding of global economic systems, corporate governance, and financial reporting standards, providing valuable insights for both practitioners and academics.

7. Conclusions

This study examines whether economic uncertainty relatively influences audit quality by using a sample of 83,511 firm-year observations from BRICS countries for 1995–2022. We use the World Uncertainty Index that Ahir et al. (2022) developed to quantify economic uncertainty. Our research indicates that increased economic uncertainty has a substantial negative impact on audit quality. This relationship is evident in both input-based measures (e.g., audit-fees-to-total-fees ratio and auditor tenure) and output-based measures (e.g., restatements and total accruals). In this regard, the study indicates that increased economic uncertainty results in a decline in audit quality, as evidenced by an increase in total accruals and restatements and a fall in the audit-fees-to-total-fees ratio and auditor tenure. The decline is ascribed to the intensified information asymmetry during times of economic uncertainty, making it challenging for auditors to gather complete and accurate information.

Moreover, we expanded our study to consider whether CEO power has played a moderating role in mitigating the adverse impact of economic uncertainty on audit quality. We have used the data reduction technique principal component analysis (PCA) to combine five different proxies for CEO power (e.g., CEO duality, CEO-founder, CEO ownership, CEO compensation slice, and CEO tenure) into a one-dimensional index for CEO power. We find that CEO power moderates the effects of economic uncertainty on both input-based and output-based measures of audit quality. This moderation effect of CEO power suggests that the level of CEO power within an organization can influence how economic uncertainty impacts audit quality, potentially neutralizing some of its negative effects.

To conclude, while this study offers a comprehensive analysis of economic uncertainty's impact on audit quality in BRICS nations from 1995 to 2022, it has limitations including a narrow geographical and temporal scope, data availability issues, and potential

measurement inadequacies of key variables such as audit quality and CEO power. Future research should broaden the scope to include more emerging economies and extended time-lines, and focus on the specific effects of major crises like the 2008 Global Financial Crisis and the 2020 COVID-19 pandemic. Additionally, exploring the role of cultural, regulatory, and institutional contexts, examining the long-term impacts of sustained economic uncertainty, and conducting comparative studies on varied auditing standards across nations could provide valuable insights. Employing advanced methodological approaches like machine learning and big data analytics may also enhance the robustness of future findings.

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Appendix A. Definitions of Variables

Variable Name	Description and Sources
<i>Dependent variables</i>	
Audit-fees-to-total-fees ratio (AFEE)	Audit fees divided by the sum of audit fees and non-audit fees for a given firm-year (Source: Datastream).
Auditor tenure (AUTE)	Number of years the current auditor is serving the organization for a given firm-year (Source: Datastream).
Restatements (REST)	Indicator variable that equals 1 if the financial statement for the year is restated for a given firm-year (Source: Datastream).
Total accruals (TACC)	Earnings before extraordinary items minus net cash flow from operations excluding extraordinary items and discontinued operations for a given firm-year (Source: Datastream).
<i>Alternative dependent variables</i>	
Audit industry specialist (AISP)	Indicator variable that equals 1 if the auditor satisfies one of the two following definitions for a given firm-year: (1) an auditor is a city industry specialist if it has the largest annual market share in an industry, based on the two-digit SIC code, and if its annual market share is at least 10 percentage points greater than its closest competitor in a city audit market; or (2) if it has an annual market share greater than 50% in an industry, based on the two-digit SIC code in the city audit market (Source: Datastream).
Going concern opinion (GOCO)	Indicator variable that equals 1 if the auditor issued a going concern opinion for a given firm-year (Source: Datastream).
<i>Independent variables</i>	
Economic uncertainty (ECUN)	Average quarterly country-specific World Uncertainty index developed by Ahir et al. (2022) (Source: https://worlduncertaintyindex.com , accessed on 2 February 2024).
<i>Alternative independent variables</i>	
Alternative economic uncertainty (AlterECUN)	The weighted average of the quarterly country-specific ECUN with weights 1 and 2 for the first and last 6 months of a year (Author's calculation).
Alternative economic uncertainty (AlterECUN ₁)	The weighted average of the quarterly country-specific ECUN with weights from 1 to 4 to each subsequent quarter in a year (Author's calculation).

Variable Name	Description and Sources
<i>Moderating variable</i>	
CEO power (CEOP)	First factor of using standard PCA of five CEO power-related variables: CEO duality, CEO-founder, CEO ownership, CEO compensation slice, and CEO tenure (Author's calculation).
CEO compensation slice (CEOC)	Total compensation the CEO received divided by the combined total compensation of the top five executives (including the CEO) for a given firm-year (Source: Datastream).
CEO duality (CEOD)	Indicator variable that equals 1 if the CEO serves as board Chair for a given firm-year (Source: Datastream).
CEO founder (CEOF)	Indicator variable that equals 1 if the CEO is one of the firm's founders for a given firm-year (Source: Datastream).
CEO ownership (CEOO)	Indicator variable that equals 1 if the percentage of equity ownership held by CEO greater than or equal to 10% for a given firm-year (Source: Datastream).
CEO tenure (CEOT)	Total length of the CEO tenure for a given firm-year (Source: Datastream).
<i>Alternative moderating variable</i>	
Alternative CEO power (AlterCEOP)	First factor of using discrete PCA of five CEO power-related variables: CEO duality, CEO-Founder, CEO ownership, CEO compensation slice, and CEO tenure (Author's calculation).
<i>Control variables</i>	
Cash flow from operations (CAFL)	Natural logarithm of operating cash flows for a given firm-year (Source: Datastream).
Firm complexity (FICO)	Sales divided by total assets in the prior year (Source: Datastream).
Firm loss (FILO)	Indicator variable that equals 1 if the earnings are negative for a given firm-year (Source: Datastream).
Firm size (FISI)	Natural logarithm of total assets for a given firm-year (Source: Datastream).
Individualism (INDI)	Individualism developed by Hofstede (2001). It is defined as "degree to which people in a society are integrated into groups". It ranges from 1 to 100 (Source: https://www.hofstede-insights.com , accessed on 2 February 2024).
Inflation (INFL)	Percentage inflation value (Source: https://databank.worldbank.org , accessed on 2 February 2024).
Inherent risk (INRI)	Ratio of accounts receivables plus inventory divided by total assets for a given firm-year (Source: Datastream).
Leverage (LEVE)	Total liabilities divided by total assets for a given firm-year (Source: Datastream).
Market capitalization (MACA)	Natural logarithm of total market capitalization of all publicly traded companies in a country in year t scaled by gross domestic product (Source: https://databank.worldbank.org , accessed on 2 February 2024).
National Governance Index (NGIN)	Average of the six indices (i.e., voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption) (Source: https://databank.worldbank.org , accessed on 2 February 2024).
Power distance index (PODI)	Power distance index developed by Hofstede (2001). It is defined as "the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally". It ranges from 1 to 100 (Source: https://www.hofstede-insights.com , accessed on 2 February 2024).
Quick ratio (QUIC)	Ratio of cash and cash equivalents plus net receivables divided by total current liabilities for a given firm-year (Source: Datastream).
Profitability (ROA)	Net income divided by total assets for a given firm-year (Source: Datastream).

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Article

Effects of Risk Committee on Agency Costs and Financial Performance

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Abstract: This study aimed to explore the influence of risk committee characteristics on agency costs and financial performance as well as investigate whether the attributes of a risk committee moderate the association between the agency costs and financial performance of financial firms listed in the Saudi Stock Market (TASI). We primarily concentrate on six attributes of risk committees (risk committee existence, size, independence, meetings, financial expertise, and busyness) and their impact on agency costs and financial performance. This study employed the ordinary least squares (OLS) and generalized methods of moments (GMM) models to explore these relationships. Using a sample of 455 observations representing the financial corporations listed on the TASI for the period from 2010 to 2022, we found that risk committees' existence, risk committee independence, and financial expertise have negative and significant associations with agency costs, but a positive influence on financial performance. However, risk committee size and busyness are positively related to agency costs and adversely associated with firms' financial performance. Furthermore, we showed that agency costs influence banks' financial performance negatively, yet risk committees oversee this risk and enhance banks' financial performance. The findings of this study have implications for financial firms, policymakers, and regulators. Beyond making empirical contributions by investigating a relatively unexplored topic in a developing Middle Eastern economy, this analysis provides valuable insights into optimizing risk committee characteristics and structures to improve financial monitoring within the framework of Saudi Arabia. This area of research has been relatively limited compared to studies conducted in developed countries.

Keywords: corporate governance; risk committee characteristics; agency costs; financial performance; financial sectors

1. Introduction

After several recent corporate failures, many proposals have been made to improve corporate governance, with a focus on risk management. An effective risk management system can assist a company to achieve its goals, improve its financial reporting, and protect its reputation. Risk management committees are considered to be vital internal mechanisms of corporate governance that improve monitoring quality, lower agency costs, and thus reduce opportunistic behavior by managers (Subramaniam et al. 2009). In support of this, Tao and Hutchinson (2013) found that corporations with separate risk committees have higher performance, as risk committees play an important role in mitigating asymmetric information. Agency theory also highlights the importance of mitigating asymmetric information between management and shareholders by increasing the level of disclosure (Jensen and Meckling 1976). In this regard, the risk committee plays an important role by providing detailed risk reports to shareholders. This transparency allows shareholders to

make more informed decisions and reduces the opportunity for managers to engage in opportunistic behaviors (Subramaniam et al. 2009). The risk reports, in turn, help integrate risk management into strategic decision-making, which assists the board of directors in making effective decisions that improve firm performance (Stulz 2022).

Nevertheless, many financial institutions have not effectively integrated risk management practices into their corporate governance, which has led to widespread failures globally. This has led to increased scrutiny of the performance, accountability, and risk-taking behavior of financial institutions. One of the main factors contributing to the financial crisis was weak corporate governance monitoring of risk management. Beasley et al. (2005) argue that public policy problems may arise if firms do not have a corporate governance mechanism to oversee enterprise risk management. On the other hand, prior studies (e.g., BCBS 2015; Berger et al. 2016; Elamer et al. 2016; Erkens et al. 2012; Gupta et al. 2013) cite the complexity and opaqueness of financial institutions' business models as a cause of poor corporate governance and risk management practices. Due to both the recent financial crisis and the complexity of financial institutions, many public policymakers, economists, and regulators emphasize the importance of addressing risk management and supporting risk governance mechanisms at financial institutions (Aljughaiman and Salama 2019; Lundqvist 2015). Aljughaiman and Salama (2019) argue that risk governance mechanisms include the creation of a separate board-level risk committee. While risk management activities were previously the responsibility of the audit committee, many corporate governance amendments now highly recommend establishing a dedicated risk committee at the board level. This is because risk committees, which oversee the firm's risk management practices, provide a focused approach to mitigating agency costs by addressing specific risk-related issues. This oversight can complement the broader mandate of audit committees, which typically focus on financial reporting and compliance (CMA 2017). Additionally, risk committees comprise members with expertise in risk management, enabling a deeper understanding of the firm's risk profile and the development of effective risk mitigation strategies (Kleffner et al. 2003). This specialization ensures that the committee can identify and address risks more efficiently than a generalist audit committee. This practice is supported by factors such as substantial regulatory amendments, the complexity of the risk environment, and financial scandals (BCBS 2015; Ng et al. 2012; Walker 2009). Therefore, a separate risk committee is more beneficial for firms with complex structures, high leverage and agency costs, or complex risk structures (Deloitte 2011).

In this respect, many financial institutions have created dedicated risk committees to oversee the enterprise risk management systems (Battaglia et al. 2014; BCBS 2015; Elamer et al. 2017; Ng et al. 2012). By having a separate risk committee with independent members with the necessary knowledge and expertise, financial institutions can better maintain a reasonable level of risk and improve risk governance to oversee risk management (Elamer et al. 2017). According to Elamer et al. (2017), a risk committee's responsibilities can include reviewing the procedures and policies, supervising risk transfer strategies, determining the methods needed to perform risk management activities throughout the organization, and maintaining direct communication with the organization's executive members, such as the CEO and other senior executives, to ensure that management implements a thorough risk management system, sets risk management objectives, and formulates a firm-wide risk management strategy. While prior studies, such as Walker (2009) and the BCBS (2010), have argued that independent risk committees are important for financial firms, there is limited evidence to support a relationship between these committees, agency costs, and firm financial performance. Mongiardino and Plath (2010) found that banks still have much room to improve their risk management practices. Other studies have emphasized the importance of creating a separate risk committee to manage all types of bank risks (Aljughaiman and Salama 2019). Therefore, this study aims to investigate the association between risk committee characteristics and agency cost risk for financial institutions that are listed in the Saudi stock market.

Saudi corporate governance regulations require companies to establish a separate risk management committee with at least three members, including a non-executive chair. The committee members must have relevant financial and risk management expertise. The committee meets at least every six months, or more often if needed. The risk management committee's duties include the following: advising the board on risk management issues, reporting risk exposures to the board and recommending actions to manage them, reassessing the company's risk tolerance and exposure on a regular basis, reviewing risk management policies, reviewing and updating the risk management strategy regularly, taking into account internal and external factors, implementing a comprehensive risk management strategy, overseeing the risk management system and assessing its effectiveness, and identifying and managing risks to the company (CMA 2017).

Empirically, Zemzem and Kacem (2014) examined the impact of risk committees' existence on the financial performance of 17 lending firms in Tunisia from 2007 to 2011. They found a negative relationship between risk committees and financial performance. In contrast, Minton et al. (2011) examined the impact of risk committees on the financial performance of 252 US banks from 2003 to 2008. They found a positive relationship between the existence of a risk committee on the board of a bank and financial performance. In terms of risk management, some studies (Aljughaiman and Salama 2019; Ellul and Yerramilli 2013; Hines and Peters 2015; Lingel and Sheedy 2012) found a negative relationship between risk governance and certain types of risk-taking. Given the above, there is mixed evidence on the relationship between risk committees and firm performance, and, in examining certain types of risk, more research is needed to determine the impact of risk committees on agency costs and firm performance in different contexts. This paper therefore aims to examine the impact of risk committees' characteristics on agency costs and the financial performance of financial firms in the Saudi Stock Market (TASI) between 2010 and 2022. Specifically, we explore the link between risk committees' existence, risk committee size, independence, meetings, expertise, busyness and agency costs, and financial performance. We found that risk committees' existence and risk committee independence and expertise have a negative and significant association with agency costs, but a positive influence on financial performance. However, risk committee size and busyness are positively related to agency costs and adversely associated with financial performance. Furthermore, we investigate the possible moderating impact of risk committee attributes on the relationship between agency costs and financial performance. We showed that agency costs influence banks' financial performance negatively, yet risk committees oversee this risk and enhance banks' financial performance.

This study contributes to the previous literature in several ways. First, we add to the prior literature investigating the association between boards of directors and agency costs (Almulhim 2022; Ertugrul and Hegde 2008; Singh and Davidson 2003) and the developing literature on the association between risk governance and firm performance and risk-taking (Aebi et al. 2012; Aljughaiman and Salama 2019; Battaglia and Gallo 2015; Ellul and Yerramilli 2013; Hines and Peters 2015; Lingel and Sheedy 2012). Specifically, to the best of our knowledge, this is the first study to investigate the influence of risk committee characteristics on agency problem risk in financial institutions listed on the Saudi stock market. Saudi Arabia's strategic location in the Middle East, along with its significant emerging economy and G20 membership, makes it a unique context for this study. In 2017, the Saudi Stock Exchange (TASI) was the largest equity market in the Middle East, boasting a total market value of approximately USD 452 billion (Rehman 2018; World Bank 2018). This substantial valuation accounted for nearly 66% of Saudi GDP that year. The evolving institutional environment in Saudi Arabia, highlighted by the introduction of Saudi Vision 2030, presents a unique scenario for this research. Vision 2030 aims to shift the kingdom from an oil-dependent economy to a knowledge-based economy and attract foreign investments (Nurunnabi 2017; Vision 2030 2016). Furthermore, unlike other studies, we extend our analysis to examine the moderating role of risk committees in the relationship between agency costs and financial performance.

The remainder of this paper is as follows: Section 2 contains the literature review and hypothesis development, Section 3 contains the data and methodology, Section 4 contains the results, and Section 5 contains the conclusion.

2. Literature Review and Hypothesis Development

Agency theory, a cornerstone in the corporate governance literature, posits that conflicts of interest arise between principals (shareholders) and agents (managers) due to the separation of ownership and control in modern corporations (Jensen and Meckling 1976). This divergence in interests can lead to agency costs, which are the expenses incurred to align the interests of managers with those of shareholders. These costs include monitoring expenditures by the principal, bonding costs by the agent, and residual loss, which is the reduction in welfare experienced by shareholders due to divergent decisions made by managers (Fama and Jensen 1983).

In the context of risk committees, their role can be seen as a mechanism to mitigate agency costs by providing an additional layer of oversight and accountability. Effective risk committees help ensure that managerial actions are closely aligned with shareholder interests, particularly in areas involving significant risk and uncertainty. For instance, the presence of a risk committee can reduce moral hazard by monitoring managerial decisions that involve high levels of risk-taking, thereby protecting the firm's assets and shareholder value (Aebi et al. 2012). Moreover, risk committees can address adverse selection by ensuring that managers do not engage in projects that may benefit them personally at the expense of shareholders (Coles et al. 2008).

Risk committees are specialized sub-groups within the board of directors that focus on identifying, assessing, and managing risks that could impact the organization's financial performance and sustainability (Yatim 2010). The effectiveness of such committees hinges on several factors, such as the expertise, independence, and busyness of their members. The following sections discuss these characteristics and their influence on agency costs and financial performance.

2.1. Existence of Risk Committee, Agency Costs and Financial Performance

Agency theory posits that risk committees play a crucial role in ensuring that managers effectively manage risk and align investments with strategic goals, thereby mitigating agency costs and enhancing financial performance (Jensen and Meckling 1976). The presence of a risk committee can help prevent financial crises by reducing performance issues associated with moral hazard and adverse selection (Aebi et al. 2012; Minton et al. 2014; Yatim 2010). Traditionally, financial institutions have prioritized asset growth and cost reduction over risk management, which has often been treated as a secondary function (Aebi et al. 2012). However, the global financial crisis underscored the necessity of prioritizing risk management, especially for banks and financial institutions with significant leverage (Oluwafemi et al. 2013).

The relationship between risk management committees and firm performance has been the subject of extensive research, yielding mixed results. Aebi et al. (2012) reported that US banks with a Chief Risk Officer (CRO) on the board performed poorly during the financial crisis, suggesting that merely having a CRO is insufficient without proper integration into the risk management framework. Conversely, Minton et al. (2011) found that US banks with dedicated risk committees outperformed their peers between 2003 and 2008, highlighting the potential benefits of specialized oversight in risk management.

Further studies have provided additional insights but also presented conflicting evidence. For instance, Hines and Peters (2015) found no significant relationship between risk committees and firm performance in the US from 1994 to 2008, suggesting that the effectiveness of risk committees may depend on other contextual factors such as the broader governance environment and specific industry practices. Yatim (2010) observed that corporations with risk committees in Malaysia exhibited poorer performance and higher agency

costs, indicating that the mere existence of risk committees does not guarantee better outcomes and may be influenced by the quality and implementation of their practices.

In Tunisia, Zemzem and Kacem (2014) identified a negative relationship between the existence of risk committees and financial performance between 2002 and 2011, further complicating the understanding of how risk committees influence firm outcomes. These mixed findings suggest that, while risk committees have the potential to mitigate agency costs and enhance financial performance, their effectiveness is contingent upon various factors, including the size of the committee, the committee's independence, the expertise of committee members, and the overall governance framework of the firm. Based on the mixed evidence from these studies, the following hypotheses are developed:

H1a: *There is a significant relationship between the existence of a risk committee and agency costs.*

H1b: *There is a significant relationship between the existence of a risk committee and the firm's financial performance.*

2.2. Risk Committee Size, Agency Costs, and Financial Performance

The size of a risk committee plays a critical role in its effectiveness. Prior studies indicated that a risk committee should have at least three members and that it should have enough power and resources to do its job well (Erkens et al. 2012). DeFond and Francis (2005) argued that the committee should have adequate authority and resources to perform effectively. Agency theory suggests that a larger risk committee with members who have different knowledge and skills is better able to monitor managers' risk-taking behavior and make sure that investments align with the company's goals. This can help to prevent financial crises by reducing the chances of adverse selection and moral hazard, which can hurt a company's performance. In other words, a larger risk committee with members who have more knowledge and skills is more likely to be effective in monitoring managers' risk-taking behavior and making sure that investments align with the company's goals. This can help to mitigate agency costs, enhance financial performance, and avoid financial crises (Aebi et al. 2012; Jensen and Meckling 1976; Yatim 2010).

Prior studies provide mixed evidence on the relationship between risk committee size and corporate financial performance. For instance, Bédard et al. (2004) and Hines and Peters (2015) found that larger risk committees are associated with better financial performance. They argue that larger committees benefit from greater diversity and expertise, which can lead to more effective decision-making and oversight.

Conversely, other studies, such as Zemzem and Kacem (2014), Ng et al. (2012), Ellul and Yerramilli (2013), and Aebi et al. (2012), reported that larger risk committees are linked to poorer financial performance. These studies suggest that larger committees may face coordination and management challenges, making them less effective at monitoring management. Additionally, Battaglia and Gallo (2015) found no significant relationship between risk committee size and performance in Indian and Chinese banks, highlighting that the impact of committee size may vary across different contexts and institutional frameworks.

The conflicting results in the literature indicate that the effectiveness of risk committees may depend on various contextual factors, such as the specific industry, regulatory environment, and the quality of risk management practices within the organization. Larger risk committees may offer potential benefits through enhanced diversity and expertise, but these advantages can be offset by increased complexity and coordination issues.

Given the mixed evidence, it is clear that more research is needed to determine the optimal size of risk committees for different types of financial institutions. Based on the reviewed literature, the following hypotheses are proposed:

H2a: *There is a significant relationship between risk committee size and agency costs.*

H2b: *There is a significant relationship between risk committee size and a firm's financial performance.*

2.3. Risk Committee Independence, Agency Costs, and Financial Performance

Agency theory posits that independent directors on the board can enhance corporate governance by providing unbiased oversight, as they are not directly tied to the company and have a reputation to uphold as effective overseers (Dionne and Triki 2005). Independent directors are therefore expected to exercise better control over management, aligning managerial actions with shareholder interests and potentially reducing agency costs. Several studies have explored the efficacy of independent directors. Hudson et al. (2001) and Wu et al. (2009) demonstrated that boards with more independent members are likely to make more objective decisions, be less influenced by management, and be more aligned with shareholder interests. This suggests that independent directors can enhance governance quality.

The relationship between director independence and firm performance, however, has yielded mixed results. Bhagat and Black (2002) found no significant relationship, which questions the effectiveness of monitoring by independent directors. On the other hand, Borokhovich et al. (2004) found that adding outside directors to the board was associated with increased risk-taking through the use of interest rate derivatives, highlighting a potential downside of increased independence.

Marsden and Prevost (2005) found no significant link between risk committee independence and board effectiveness, suggesting that mere independence may not be sufficient for effective risk oversight. Conversely, Zemzem and Kacem (2014) reported a positive relationship between the proportion of independent risk committee members and financial performance in Tunisian lending businesses, indicating that independence can contribute positively in certain contexts.

Kallamu et al. (2013) also found a positive correlation between the percentage of independent directors on the risk committee and both financial performance and market valuations, reinforcing the notion that independence can enhance firm outcomes. However, Yeh et al. (2011) found a strong negative relationship between the proportion of independent directors and financial performance among the largest financial institutions from industrial countries, suggesting that too much independence might hinder effective decision-making.

The mixed evidence from these studies indicates that the impact of risk committee independence on firm performance and agency costs is context-dependent. Given the conflicting findings, it is clear that more research is needed to understand the conditions under which independent risk committees can be most effective. Therefore, the following hypotheses can be developed:

H3a: *There is a significant relationship between risk committee independence and agency costs.*

H3b: *There is a significant relationship between risk committee independence and a firm's financial performance.*

2.4. Risk Committee Meetings, Agency Costs, and Financial Performance

The primary function of risk committees is to ensure risks are regularly examined, evaluated, handled, and communicated, so risk management actions are not delayed. According to agency theory, regular committee gatherings are essential as infrequent meetings can result in ineffectiveness. The number of meetings per year also signifies the level of effort dedicated to fulfilling the committee's roles and responsibilities. Jackling and Johl (2009) argue that frequent board meetings can help connect the company to the outside world and improve its performance. This is a more concise and idiomatic way to state the findings. Smith (2003) also recommends that risk committees meet at least three times a year. Abbott and Parker (2000) found that more meetings make fraudulent reporting and activities less likely. However, Ferrero-Ferrero et al. (2012) found that more board meetings are only helpful during crises and can hurt company performance during times of growth. Based on this evidence, it seems that the number of committee meetings

has a big impact on how well the committee works and how well it achieves its goals. With respect to the Financial Reporting Council (FRC) (2014), all board committee directors of UK corporations shall attend the yearly general meeting. This is mandatory to enable all committee directors to share their perspectives with the board of directors. Additionally, the (FRC) mandates all risk committees to have at least four meetings per year or more if necessitated by particular situations.

Agency theory suggests that regular risk committee meetings can help to reduce conflict between shareholders and managers. The theory proposes that more frequent risk committee meetings improve communication among stakeholders involved in risk management. Additionally, by meeting more often, risk committees can more closely examine critical risk management aspects, such as risk appetite, risk avoidance, and risk awareness. The frequency of risk committee meetings is therefore a measure of the committee's dedication and diligence (Cheung et al. 2010; Battaglia et al. 2014).

Not much research has looked at the relationship between how often risk committees meet and how well a company performs financially. Hoque et al. (2013) showed no link between the frequency of risk committee meetings and financial performance. Ellul and Yerramilli (2013), on the other hand, found a positive association between the frequency of risk committee meetings and financial performance. However, Ng et al. (2012) and Aebi et al. (2012) indicated an adverse correlation between the frequency of risk committee meetings and financial performance. We therefore build our fourth hypothesis as follows:

H4a: *There is a significant relationship between risk committee meetings and agency costs.*

H4b: *There is a significant relationship between risk committee meetings and a firm's financial performance.*

2.5. Risk Committee Expertise, Agency Costs, and Financial Performance

Research has consistently shown that directors with the right skills and experience can significantly improve a company's financial performance by reducing uncertainty and effectively managing challenges (Dionne et al. 2013; Al-Hadi et al. 2016). Financial experts on the board are particularly valuable as they can identify beneficial risks for shareholders and persuade management to capitalize on these opportunities (Minton et al. 2014). This is especially critical for financial companies, which are inherently complex and require specialized knowledge to navigate effectively.

According to agency theory, directors equipped with the necessary skills and qualifications play a crucial role in protecting the company's interests by enhancing transparency and safeguarding shareholder rights. Skilled directors are expected to ensure that the company is not exposed to undue business risks and that robust risk management practices are in place. By adhering to best practices in risk management, these directors help the company mitigate business risks, which can positively influence financial performance (Aldhamari et al. 2020).

The literature on the relationship between director expertise and firm performance has produced compelling evidence. Dionne et al. (2013) found that directors with specific expertise in risk management can significantly enhance a firm's ability to manage risk, thereby improving financial performance. Al-Hadi et al. (2016) supported these findings, demonstrating that qualified directors are better equipped to identify and manage risks, leading to improved company outcomes.

Minton et al. (2014) argued that financial experts on risk committees are particularly adept at identifying strategic risks that can be advantageous to shareholders. This expertise allows them to guide management in taking calculated risks that align with the company's strategic objectives. Such insights are vital for financial firms, which often deal with high levels of complexity and risk.

On the other hand, some studies suggest that merely having financial experts on the board is not a panacea. The effectiveness of these directors also depends on their ability to

work cohesively with other board members and management. For instance, Aldhamari et al. (2020) highlighted the importance of collaborative dynamics in ensuring that risk management practices are effectively implemented. Without a collaborative approach, even the most skilled directors may struggle to influence the company's risk management strategies positively.

In synthesizing these findings, it is clear that the presence of directors with the right skills and experience is crucial for effective risk management and improved financial performance. However, their impact is also contingent on the board's overall dynamics and the firm's specific context. Based on this synthesis, the following hypotheses are proposed:

H5a: *There is a significant relationship between risk committee expertise and agency costs.*

H5b: *There is a significant relationship between risk committee expertise and a firm's financial performance.*

2.6. Risk Committee Busyness, Agency Costs, and Financial Performance

The busyness of risk committee members—measured by the number of other board memberships they hold—can significantly impact a company's financial performance and agency costs. If risk committee directors are overloaded with responsibilities from serving on multiple boards, they may lack the time and focus needed to perform their duties effectively. This lack of attention could lead to the approval of riskier projects that might harm the company's bottom line (Almulhim 2022).

Research by Fich and Shivdasani (2006) supports this concern, showing that companies with risk committee directors who serve on multiple boards tend to be less profitable. The primary argument here is that overcommitted directors may struggle to provide the necessary oversight, leading to increased agency costs and suboptimal financial outcomes.

Conversely, other studies suggest that busy directors can bring valuable external knowledge and broader networks to the companies they serve. Field et al. (2013) found that busy boards might help companies increase their value, leveraging their diverse experiences and connections. However, this positive relationship tends to be weaker for older, more established firms, suggesting that the impact of director busyness may vary depending on the company's maturity and specific needs.

Brown et al. (2019) provide additional nuance by demonstrating that companies that reduced the number of directorships held by their board members saw improvements in financial performance. This finding indicates that while the benefits of having well-connected directors are acknowledged, there is a threshold beyond which their busyness becomes detrimental.

Despite the varying perspectives, a consensus exists that director busyness affects both agency costs and firm performance, albeit in complex ways. On one hand, overcommitted directors may increase agency costs by being less effective at monitoring management, as noted by Almulhim (2023). On the other hand, Field et al. (2013) argue that the benefits of having directors with extensive external connections and knowledge can, in some cases, outweigh the drawbacks.

To synthesize, the current state of research suggests a nuanced relationship between risk committee busyness and financial performance. The effectiveness of busy directors appears to depend on the balance between their external commitments and their ability to leverage outside experiences for the company's benefit. Therefore, the following hypotheses can be developed:

H6a: *There is a significant relationship between risk committee busyness and agency costs.*

H6b: *There is a significant relationship between risk committee busyness and a firm's financial performance.*

3. Data and Methodology

3.1. Data Sample

We conducted our study on the Saudi Stock Exchange (TASI), particularly financial sectors for a 10-year period from 2010 to 2022. This study's initial sample was all financial institutions listed on the TASI, which are 40 companies. However, we excluded three financial companies with missing risk committee characteristics or financial performance data for at least three consecutive years. This reduced the sample to 37 corporations. We dropped an additional two companies due to mergers and acquisitions that happened during our study sample (Aljughaiman and Salama 2019). This study's final sample was therefore 35 financial companies with 455 observations over time. Table 1 illustrates the classification of the study industries. In addition, risk committee variables (risk committee existence, size, independence, meetings, expertise, and busyness) are collected from firms' annual reports and websites. Agency costs, financial performance, and control variables are all collected from the Bloomberg database.

Table 1. Classification of industries of sample corporations.

Industries	Number of Firms	Proportion of Firms Per Industry
Banks	8	22.9
Insurance	27	77.1
Total	35	100

3.2. Measures

3.2.1. Financial Performance Variables

Following prior studies in the literature (e.g., Cochran and Wood 1984; Baysinger and Butler 1985; Hoskisson et al. 1994; Jackling and Johl 2009; Patel 2018; Aljughaiman et al. 2024a), we employ two proxies for the performance of firms, namely, return on assets (ROA) and return on equity (ROE). Both variables are considered accounting-based measures since they are related to measuring historical performance and thus experience more inward- and backward-looking focus. They are used to assess several factors, such as the effectiveness of the previous advice and recommendations provided by the board of directors to the firm's management team (Kiel and Nicholson 2003). We measure our dependent variables as shown in Equations (1) and (2) below:

$$ROA = \frac{\text{net income}}{\text{total assets}} \quad (1)$$

$$ROE = \frac{\text{net income}}{\text{total equity}} \quad (2)$$

3.2.2. Agency Costs Variable

A bank's performance can improve when its board of directors and committees reduce agency problems. For example, a risk committee that is not effective may not monitor the bank closely enough, which can lead to bad decision-making and higher agency costs (Almulhim 2022). As shown in Equation (3) below, agency costs in banks are measured by dividing cash by total assets. A higher value indicates higher agency costs (Frag et al. 2018; Trinh et al. 2020).

$$AGENCY = \frac{\text{cash}}{\text{total assets}} \quad (3)$$

3.2.3. Risk Committee Variables

We employ six characteristics of risk committees (risk committee existence, size, independence, meetings, expertise, and busyness) to explore their association with agency costs and financial performance. Risk committee existence (RCE) takes a value of 1 if the financial

institution has a separate risk committee and 0 otherwise. Risk committee size (RCSZ) is the total number of members on the risk committee. Risk committee independence (RCIND) is the total number of independent members to the total number of risk committee directors. Risk committee meetings (RCMETs) are the total number of risk committee meetings per year. Risk committee expertise (RCEXP) is the total number of members with risk backgrounds to the total number of risk committee directors. Risk committee busyness (RCBUSY) is the total number of members who have at least two board seats to the total number of the risk committee directors.

3.2.4. Control Variables

Following prior studies in the literature, such as (Almulhim 2022), we use several control variables to explore the association between risk committee characteristics, agency costs, and financial performance. In detail, corporate size, corporate age, book-to-market value, and financial leverage. Corporate size (ASSETS) is the natural logarithm of the total assets. Corporate age (LAGE) is the corporate age since its establishment. Book-to-market value (BTMV) is the book value of equity divided by the market value of equity. Financial leverage (FLEVG) is the total debt divided by total assets. In addition, we control for year and industry effects by employing dummy variables for both. This can make our model more robust and consistent. Table 2 illustrates the above-defined variables in terms of measurements and data sources.

Table 2. Measurements and data sources of study variables.

Variables	Measurements	Data Sources
Dependent variables		
Return on assets (ROA)	Net income/total assets	Bloomberg
Return on equity (ROE)	Net income/total equity	Bloomberg
Agency costs (AGENCY)	Cash/total equity	Bloomberg
Independent variables		
Risk committee existence (RCE)	1 if the financial institution has a separate risk committee and 0 otherwise.	Company reports
Risk committee size (RCSZ)	Total number of members on the risk committee.	Company reports
Risk committee independence (RCIND)	Total number of independent members/total number of the risk committee directors.	Company reports
Risk committee meetings (RCMETs)	Total number of risk committee meetings per year.	Company reports
Risk committee expertise (RCEXP)	Total number of members with risk backgrounds/total number of the risk committee directors.	Company reports
Risk committee busyness (RCBUSY)	Total number of members who have at least two board seats/total number of the risk committee directors.	Company reports
Control variables		
Corporate size (ASSETS)	Nature logarithm of the total assets.	Bloomberg
Corporate age (LAGE)	Corporate age since its establishment.	Bloomberg
Book-to-market ratio (BTMV)	Book value of equity divided by the market value of equity.	Bloomberg
Financial leverage (FLEVG)	Total debt divided by total assets.	Bloomberg

3.3. Estimation Models

To explore the influence of risk committee attributes on agency costs and financial performance, we employ the OLS regression model using different financial performance measures, in addition to our control variables and year and industry dummies. Additionally, to address the issue of heteroscedasticity, robust standard errors are employed in the model. We also use the system GMM as a robustness check to address endogeneity issues,

such as dynamic endogeneity, omitted variable bias, and reverse causality. Equations (4)–(6) illustrate the study models as follows:

$$AGENCY_{it} = \beta_0 + \beta_1 RCE_{it} + \beta_2 RCSZ_{it} + \beta_3 RCIND_{it} + \beta_4 RCMET_{it} + \beta_5 RCEXP_{it} + \beta_6 RCBUSY_{it} + \beta_7 ASSETS_{it} + \beta_8 LAGE_{it} + \beta_9 BTMV_{it} + \beta_{10} FLEV_{it} + \epsilon_{it} \quad (4)$$

$$ROA_{it} = \beta_0 + \beta_1 RCE_{it} + \beta_2 RCSZ_{it} + \beta_3 RCIND_{it} + \beta_4 RCMET_{it} + \beta_5 RCEXP_{it} + \beta_6 RCBUSY_{it} + \beta_7 ASSETS_{it} + \beta_8 LAGE_{it} + \beta_9 BTMV_{it} + \beta_{10} FLEV_{it} + \epsilon_{it} \quad (5)$$

$$ROE_{it} = \beta_0 + \beta_1 RCE_{it} + \beta_2 RCSZ_{it} + \beta_3 RCIND_{it} + \beta_4 RCMET_{it} + \beta_5 RCEXP_{it} + \beta_6 RCBUSY_{it} + \beta_7 ASSETS_{it} + \beta_8 LAGE_{it} + \beta_9 BTMV_{it} + \beta_{10} FLEV_{it} + \epsilon_{it} \quad (6)$$

For Equation (4), *AGENCY_{it}* is agency costs; *RCE_{it}* is risk committee existence; *RCIND_{it}* is risk committee size; *RCIND_{it}* is risk committee independence; *RCMET_{it}* is risk committee meetings; *RCEXP_{it}* is risk committee expertise; *RCBUSY_{it}* is risk committee busyness; *ASSETS_{it}* is corporate size; *LAGE_{it}* is corporate age; *BTMV_{it}* is book-to-market ratio; *FLEV_{it}* is financial leverage; ϵ_{it} is the error term. For Equations (5) and (6), *ROA_{it}* and *ROE_{it}* are return on assets and return on equity, respectively.

4. Results

4.1. Descriptive Statistics and Correlations

Table 3 illustrates the descriptive statistics of the risk committee attributes, agency costs, financial performance, and control variables. For the financial performance, the mean (standard deviation) of ROA and ROE were 2.2% and 1.2% (0.7% and 4.3%), respectively. Regarding the agency costs variable, AGENCY had an average value of 8.6% and a standard deviation of 0.034%. Moving to the risk committee variables, RCE had a minimum value of 0 and a maximum value of 1. RCAZ had a minimum value of 3 and a maximum value of 5. RCIND had an average percentage of 64% and a maximum percentage of 83%. RCMET had a minimum value of 2 and a maximum value of 6. RCEXP (RCBUSY) had an average percentage of 52% (66%). With regard to the control variables, the mean values (of ASSETS, LAGE, BTMV, and FLEV) were 7.9 million, 38 years, 75%, and 26%, respectively.

Table 3. Descriptive statistics.

Variables	Observation	Mean	SD	Min	Max
ROA	455	0.022	0.007	0.004	0.038
ROE	455	0.012	0.043	0.019	0.226
AGENCY	455	0.086	0.034	0.001	0.287
RCE	455	0.989	0.331	0.000	1.000
RCSZ	455	4.108	0.847	3.000	5.000
RCIND	455	0.642	0.128	0.433	0.830
RCMET	455	3.77	1.091	2.000	6.000
RCEXP	455	0.522	1.077	0.433	0.600
RCBUSY	455	0.666	0.221	0.400	0.100
ASSETS	455	7.915	0.332	5.187	8.704
LAGE	455	38.77	15.83	5.000	66.00
BTMV	455	0.755	0.443	0.001	1.889
FLEV	455	0.261	0.053	0.013	0.531

Note: ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCE is risk committee existence, RCSZ is the risk committee size, RCIND is the risk committee independence, RCMET is risk committee meetings, RCEXP is risk committee expertise, RCBUSY is risk committee busyness, ASSETS is company size, LAGE is company age, BTMV is book to market value, and FLEV is financial leverage.

We employed the Pearson correlation matrix test to check that our explanatory variables had no multicollinearity issues. Table 4 shows that the highest association among our study variables was between RCSZ and RCMET with about 70%. This implies that the larger the size of the risk committee is, the greater the number of meetings held by the

committee. More importantly, our data have no multicollinearity issues as all correlations are below 80%.

Table 4. Pearson correlation matrix for the risk committee, agency costs, and financial performance association.

	ROA	ROE	AGENCY	RCE	RCSZ	RCIND	RCMET	RCEXP	RCBUSY	ASSETS	LAGE	BTMV	FLEVG
ROA	1.000												
ROE	0.847 *	1.000											
AGENCY	−0.764 *	−0.786 *	1.000										
RCE	0.131	0.127	−0.379 *	1.000									
RCSZ	0.125	0.003	−0.425 *	0.225	1.000								
RCIND	0.011 *	0.073 *	−0.448 *	0.136 *	0.504 *	1.000							
RCMET	−0.043	−0.045	0.393	0.086	0.707 *	0.581 *	1.000						
RCEXP	0.114 *	0.069	−0.448 *	0.130	0.371 *	0.466 *	0.552 *	1.000					
RCBUSY	−0.228 *	−0.273 *	0.464 *	−0.042 *	−0.587 *	−0.439 *	−0.446 *	−0.363 *	1.000				
ASSETS	0.561 *	0.522 *	−0.715 *	0.226 *	0.485 *	0.023	0.170	0.063	−0.262 *	1.000			
LAGE	0.335 *	0.433 *	0.448	0.005	0.314	0.163	0.162	0.004	−0.237 *	0.764 *	1.000		
BTMV	−0.118	−0.272 *	0.092	−0.031	−0.218 *	−0.106 *	−0.361 *	−0.338 *	0.128	−0.052	−0.188	1.000	
FLEVG	−0.074	−0.054	0.116 *	−0.375	−0.206 *	−0.095	−0.092	−0.060	−0.060 *	−0.127	−0.304 *	0.245	1.000

Note: ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCE is risk committee existence, RCSZ is the risk committee size, RCIND is the risk committee independence, RCMET is risk committee meetings, RCEXP is risk committee expertise, RCBUSY is risk committee busyness, ASSETS is company size, LAGE is company age, BTMV is book to market value, and FLEVG is financial leverage. * means significance level at 5%.

4.2. Multivariate Analyses

4.2.1. Effects of Risk Committee on Agency Costs and Financial Performance

Table 5 presents the results of the baseline models utilizing pooled OLS with robust standard errors to address potential heteroscedasticity concerns. The results show that risk committee existence (RCE) is positive and statistically significant for both return on assets (ROA; $\beta = 0.003$ at $p < 0.05$) and return on equity (ROE; $\beta = 0.019$ at $p < 0.1$). This suggests that the existence of an effective risk committee enhances financial performance, supporting Hypothesis 1 (H1). These findings align with previous research by Minton et al. (2011) and Bhuiyan et al. (2021), which indicated that effective risk committees are positively associated with firm performance. This highlights the importance of having risk committees to manage risk and enhance financial performance. In contrast, RCE has an insignificant relationship with agency costs. This study also finds that risk committee size (RCSZ) has a significant and negative impact on ROE ($\beta = -0.069$ at $p < 0.1$). This supports Hypothesis 2 (H2), which states that risk committee size can have a negative association with firm performance. This finding is consistent with the recent literature stating that large risk committees may create higher challenges in managing and monitoring team performance (Ellul and Yerramilli 2013; Ng et al. 2012; Zemzem and Kacem 2014). RCSJ is positively associated with agency costs and implies that agency costs would be increased by risk committee size, which is the opposite of our prediction that the literature has suggested. RCSZ is positively associated with agency costs, which means that agency costs can be increased by risk committee size. The estimated coefficients of risk committee independence (RCIND) are positive and statistically significant for both measures of the firm's financial performance ($\beta = 0.009$ at $p < 0.05$; $\beta = 0.070$ at $p < 0.05$). This supports Hypothesis 3 (H3), which states that an increase in the percentage of independent risk committees would be reflected positively in financial performance. This suggests that having independent members on the risk committee can encourage decision-making free from management team influence, allowing for a stronger focus on shareholder interests. These findings are in accordance with the studies by Zemzem and Kacem (2014) and Kallamu et al. (2013). Contrary to expectations, risk committee meetings (RCMETs) are not linked to financial performance, so Hypothesis 4 (H4) is rejected. However, risk committee expertise (RCEXP) has a significant and positive association with financial performance in both measurements, and it can reduce agency costs at a p -value of 0.05. Finally, risk committee busyness (RCBUSY) is significantly and negatively associated with financial

performance and significantly increases agency costs. Risk committees with busy members are more likely to increase agency costs and reduce the performance of firms. These findings are in line with previous studies in the literature (Almulhim 2023; Fich and Shivdasani 2006).

Table 5. Risk committee, agency costs, and financial performance.

VARIABLES	(1) ROA	(2) ROE	(3) AGENCY
RCE	0.003 ** (1.997)	0.019 * (1.698)	−0.398 (0.896)
RCSZ	−0.002 (0.734)	−0.069 *** (3.208)	0.489 ** (2.257)
RCIND	0.009 ** (2.071)	0.070 ** (2.212)	−6.039 *** (4.543)
RCMET	−0.001 (0.579)	0.011 (0.244)	−0.017 (0.125)
RCEXP	0.009 * (1.680)	0.023 * (0.558)	−0.534 ** (2.277)
RCBUSY	−0.012 *** (3.219)	−0.108 *** (3.785)	4.464 *** (4.855)
ASSETS	0.094 *** (4.332)	0.710 *** (4.531)	−6.791 *** (8.993)
LAGE	−0.003 (0.681)	−0.004 (0.894)	0.063 ** (6.603)
BTMV	0.002 ** (2.012)	0.026 *** (3.124)	−1.976 ** (6.154)
FLEVG	−0.012 (1.242)	−0.153 ** (2.262)	0.367 *** (2.696)
Constant	−0.191 *** (4.071)	−1.175 *** (3.425)	−0.367 *** (8.494)
Observations	455	455	455
R-squared	0.490	0.612	0.446
Year/Industry dummy	YES/YES	YES/YES	YES/YES

Note: ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are found in parentheses. ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCE is risk committee existence, RCSZ is the risk committee size, RCIND is the risk committee independence, RCMET is risk committee meetings, RCEXP is risk committee expertise, RCBUSY is risk committee busyness, ASSETS is company size, LAGE is company age, BTMV is the book-to-market value, and FLEVG is financial leverage.

The size of a company (ASSETS) is positively and significantly linked to financial performance at a p -value of 1%. However, it is negatively and significantly linked to agency costs, which suggests that larger firms may mitigate agency costs. The book-to-market ratio is positively and significantly linked to financial performance but negatively and significantly linked to agency cost performance at $p < 0.05$, respectively. Financial leverage is negatively and statistically significantly associated with a firm's financial performance. In contrast, our findings suggest that financial leverage may increase agency costs.

4.2.2. Effects of Risk Committee on Agency Costs and Financial Performance (Robustness Check)

To ensure robustness and mitigate or control endogeneity, we will implement a different econometric estimation method. According to Almulhim and Aljughaiman (2023), the primary estimating approach that effectively addresses issues of endogeneity, simultaneity, and causality concerns is the generalized method of moments (GMM). Additionally, GMM is considered a more suitable model compared to other estimators for the endogeneity problem (Aljughaiman et al. 2024b; Wintoki et al. 2012). Thus, we examined our data using the GMM system approach to ensure the robustness of our findings in Table 6.

The two-step GMM estimations used in this study lagged the dependent variables, financial performance and agency costs. We followed Wintoki et al. (2012) to use this technique to account for any endogeneity (reverse causality), which could not be observed in our initial results. Table 6 presents the results of the Arellano–Bond second-order

autocorrelation test for both measures of firm performance. The p -values of 0.285, 0.391, and 0.136 indicate that there is no significant serial autocorrelation in this test. With a p -value greater than 10%, the Hansen J test is not statistically significant, indicating that the instruments used are valid and do not correlate with the error term.

Table 6. Risk committee, agency costs, and financial performance (system GMM).

VARIABLES	(1) ROA	(2) ROE	(3) AGENCY
RCE	0.009 *	0.032 **	−0.115
	(0.268)	(0.873)	(0.874)
RCSZ	−0.001 *	−0.064 **	0.947 ***
	(0.042)	(0.882)	(0.847)
RCIND	0.012 ***	0.070 *	−2.015 **
	(0.591)	(0.315)	(0.327)
RCMET	−0.018	0.019	−0.018
	(0.071)	(0.183)	(0.153)
RCEXP	0.015 **	0.043 **	−0.412 *
	(0.052)	(0.082)	(0.153)
RCBUSY	−0.017 **	−0.172 **	1.662 **
	(0.661)	(0.753)	(0.432)
ASSETS	0.096 **	0.670 ***	−1.610 ***
	(0.080)	(0.136)	(1.730)
LAGE	−0.013	−0.016	0.069 ***
	(0.032)	(0.285)	(0.118)
BTMV	0.012 *	0.044 **	−0.543 *
	(0.011)	(0.775)	(0.061)
FLEVG	−0.019	−0.038 **	0.134 **
	(0.158)	(0.667)	(0.346)
Constant	−0.132 **	−1.610 *	−0.258 **
	(0.486)	(0.113)	(0.091)
Observations	455	455	455
AR(1)	0.000	0.000	0.000
AR(2)	0.285	0.391	0.136
Hansen test of over-identification (p -value)	0.572	0.622	0.338
Year/Industry dummy	YES/YES	YES/YES	YES/YES

Note: ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are found in parentheses. ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCE is risk committee existence, RCSZ is the risk committee size, RCIND is the risk committee independence, RCMET is risk committee meetings, RCEXP is risk committee expertise, RCBUSY is risk committee busyness, ASSETS is company size, LAGE is company age, BTMV is the book-to-market value, and FLEVG is financial leverage.

The two-step GMM estimation method shown in Table 6 still reveals a similar relationship between the characteristics of the risk committee and both firm performance and agency costs compared to the OLS findings. Hypotheses H1, H2, and H4 are again accepted, and these findings are robust.

4.2.3. Effects of Risk Committee Index on Agency Costs and Financial Performance (Additional Test)

Table 7 also extend our analysis by merging our main risk committee variables into one index that reflects the risk governance effectiveness. Specifically, we merge the risk committee variables of (1) size, (2) independence, (3) busyness, (4) number of meetings, (5) number of financial experts, and (6) dedicated risk committee. We follow Aljughaiman and Salama's (2019) approach in building our risk committee index. We create an index that has a value ranging between 0 and 6. The value of this index is accumulated based on the dummy variables that we mentioned previously. In detail, we create dummy variables for each risk committee's characteristics. (1) Dummy of RC size takes the value of 1 if the RC size value is more than its mean value, (2) Dummy of RC independent takes the value of 1 if the RC independent value is more than its mean value, (3) Dummy of RC meeting takes the value of 1 if RC meeting value is more than its mean value, (4) Dummy of RC busyness takes the value of 1 if RC busyness value is less than its mean value, (5) Dummy of RC financial experts takes the value of 1 if RC

financial experts value is more than its mean value, and (6) Dummy of RC dedicated takes the value of 1 if banks has a separated risk committee, otherwise 0.

Table 7. Additional test: risk committee index, agency costs, and financial performance.

VARIABLES	(1) ROA	(2) ROE	(3) AGENCY
RCIndex	0.099 *** (0.053)	0.019 ** (0.074)	−0.062 *** (0.013)
ASSETS	0.094 *** (0.026)	0.710 *** (0.013)	−0.174 *** (0.194)
LAGE	−0.006 * (0.001)	−0.002 (0.008)	0.004 * (0.002)
BTMV	0.016 * (0.035)	0.007 ** (0.062)	−0.058 * (0.052)
FLEVG	−0.027 * (0.04)	−0.050 ** (0.022)	0.047 ** (0.094)
Constant	−0.191 *** (0.018)	−1.175 * (0.520)	−0.367 ** (0.963)
Observations	455	455	455
R-squared	0.512	0.638	0.481
Year/Industry dummy	YES/YES	YES/YES	YES/YES

Note: ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are found in parentheses. ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCIndex is the risk committee index, ASSETS is company size, LAGE is company age, BTMV is the book-to-market value, and FLEVG is financial leverage.

4.2.4. Moderating Role of Risk Committee Index on Agency Costs and Financial Performance (Additional Test)

We also extend our analysis by investigating the moderating role of risk committees in the association between agency cost and financial performance. Table 8 shows the analysis for this test. The results in Table 8 show that risk committee activities control agency costs at banks, leading to improved financial performance. In more detail, Table 8 shows that agency costs influence banks' financial performance negatively, but risk committee oversight mitigates this risk and enhances banks' financial performance. The results confirm the important role of risk committees in overseeing all types of risks at firms in the financial industry.

Table 8. Additional test: moderating role of risk committee index on agency costs and financial performance.

VARIABLES	(1) ROA	(2) ROE
AGENCY	−0.047 *** (0.013)	−0.174 *** (0.194)
RCIndex	0.099 *** (0.053)	0.019 ** (0.074)
AGENCY*RCIndex	0.062 ** (0.094)	0.189 ** (0.094)
ASSETS	0.094 *** (0.026)	0.710 *** (0.013)
LAGE	−0.006 * (0.001)	−0.002 (0.008)
BTMV	0.016 * (0.035)	0.007 ** (0.062)
FLEVG	−0.027 * (0.04)	−0.050 ** (0.022)
Constant	−0.191 *** (0.018)	−1.175 * (0.520)
Observations	455	455
R-squared	0.490	0.612
Year/Industry dummy	YES/YES	YES/YES

Note: ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are found in parentheses. ROA is the return on assets, ROE is the return on equity, AGENCY is agency costs, RCIndex is risk committee index, AGENCY*RCIndex is the moderating factor of agency costs and risk committee index, ASSETS is company size, LAGE is company age, BTMV is the book-to-market value, and FLEVG is financial leverage.

5. Conclusions

The main goal of this paper was to explore the link between risk committee characteristics on agency costs and financial performance as well as the moderating impact of risk committee characteristics on agency costs and financial performance. The studied sample contained financial firms listed on the Saudi Stock Market (TASI) for 13 years from 2010 to 2022. This topic had not previously been investigated with respect to the TASI. In addition, our contribution was extended by targeting the comprehensive attributes of the risk committee (risk committee existence, size, independence, meetings, expertise, and busyness) rather than focusing on particular mechanisms of the risk committee. We also extended our contribution by analyzing the moderating effects of the risk committee on agency costs and financial performance. Regarding methodology, we employed OLS as the primary estimation tool in this paper, together with the system GMM model in order to control for any possible endogeneity issues.

Regarding the results of this paper, we found that risk committees' existence, risk committee independence, and expertise have a negative and significant association with agency costs, but a positive influence on financial performance. However, risk committee size and busyness are positively related to agency costs and adversely associated with financial performance. Furthermore, we investigate the possible moderating impact of risk committee attributes on the relationship between agency costs and financial performance. We showed that agency costs influence banks' financial performance negatively, yet risk committees oversee this risk and enhance banks' financial performance.

Overall, this study has implications for financial firms, policymakers, and regulators. Financial firms can leverage these insights to enhance their governance practices by carefully considering the composition of their risk committees. Specifically, it is crucial to avoid overloading committee members with excessive responsibilities. Busy members, as indicated by this study, are more likely to contribute to increased agency costs and decreased firm performance. Firms should ensure that risk committee members have adequate time and resources to fulfill their duties effectively. This might involve setting limits on the number of committees a member can serve on or ensuring that members are not overburdened with other board responsibilities.

Policymakers can utilize the findings to refine regulatory frameworks governing risk management in financial institutions. Regulations could mandate specific qualifications for risk committee members, ensuring they have the necessary expertise and time to dedicate to their roles. Furthermore, guidelines could be established to limit the number of directorships a single individual can hold, thereby preventing the negative impacts of overcommitment on governance quality and firm performance.

Our work has some limitations, such as that we employed only one measure of agency costs. Future work therefore can employ more proxies for agency costs to explore its impact on financial performance. Moreover, our sample covered the period from 2010 to 2022, and we found that different characteristics of risk committees have different effects on agency costs and financial performance. Future studies may examine this association before and during the COVID-19 pandemic.

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Article

The Impact of Board Gender Diversity on European Firms' Performance: The Moderating Role of Liquidity

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Abstract: This study examines how board gender diversity affects listed non-financial European companies' financial performance. Data from the Refinitiv Eikon Platform—LSEG and World Bank databases was used to complete the analysis. The total sample included 4257 companies for the period 2011–2023. This study examined board gender diversity and its interaction with liquidity while controlling for board characteristics such as board size, independence, and board meetings. Controlling for firm characteristics (firm size and leverage) and macroeconomic variables like inflation and GDP. This study estimated the connection using panel regression. Due to Hausman test significance, fixed effect estimation was used. The findings demonstrated a notable and favorable influence of board features, such as gender diversity, board independence, and board size, on European nonfinancial companies. Additionally, liquidity positively affects firm performance. Furthermore, the findings indicated that leverage had a significant negative impact on profitability. Finally, both the size and GDP have a significant beneficial impact on profitability. Our findings indicate that an increased representation of women on the board of directors is associated with greater independence among board members and a higher number of board members being hired. This, in turn, has a positive impact on profitability due to the extensive experience shared among board members. Additionally, this leads to improved governance, enabling better control over decisions and a greater focus on the long-term investment strategy of the company. Our results are robust, as are similar results reported by the GMM regression.

Keywords: firm performance; gender diversity; board size; board meetings; board independence; liquidity; firm size; profitability; leverage; panel regression

JEL Classification: C01; C23; G20; G30; G31; G32; G34; G38

1. Introduction

Corporate strategy, board composition, and firm performance are crucial elements in today's business environment that jointly influence the path and success of an organization (Al-Shaer et al. 2023). Ensuring the harmonization of these factors is crucial for maintaining a competitive edge and maximizing the value for shareholders (Salem et al. 2019). Multiple empirical investigations have clarified the intricate connections between these characteristics and their impact on company results in diverse geographical and sector-specific settings (Pucheta-Martínez and Gallego-Álvarez 2020). Shleifer and Vishny (1997) define corporate governance as the collection of methods by which capital providers ensure shareholder profitability, according to the literature on this topic. Denis and McConnell (2003) have highlighted the significance of differentiating between internal and external systems of governance and their relevance to fund providers at every stage of value creation. The

mix of abilities, backgrounds, and diversity among the people who make up a board of directors has a big impact on how decisions are made (Mishra and Kapil 2018).

The ongoing academic discussion over the practical and financial effects of board gender diversity has not been conclusively settled in recent decades (Laique et al. 2023; Shahrour et al. 2022). The primary duty of a company's board of directors is to offer strategic advice in decision-making by balancing the interests of managers and shareholders (Finkelstein et al. 2009). A perceptive corporate board serves as a valuable strategic asset, enabling firms to obtain a competitive edge in the market by leveraging their expertise, experience, and corporate networks (Palmberg et al. 2009). A substantial portion of the earlier literature has provided evidence for the importance of BGD in improving corporate performance and better risk management and governance (Lee et al. 2014). The main rationale behind board gender diversity's favorable influence lies in the notion that female directors tend to exhibit risk aversion and ethical behavior (Guizani and Abdalkrim 2021).

The growth in major corporate failures in recent times has led to a lack of complete adherence to corporate governance. These breakdowns are frequently associated with inadequate corporate governance processes in organizations that seek to generate economic value (García-López et al. 2024). Adopting these recommended methods improves the efficiency of managers, increases the trust of investors, and eliminates circumstances that could decrease the worth of shareholders. It also minimizes waste and inefficiency (Geraldine et al. 2017). The substantial corporate losses and failures witnessed during the commencement of the global financial crisis in 2008 highlight the crucial role of strong corporate governance in maintaining a thriving business environment and protecting the interests of stakeholders (Lin et al. 2020). Due to the significant consequences of recent worldwide company collapses, it is crucial to prioritize the enhancement of corporate governance procedures in order to safeguard the interests of shareholders, strengthen the financial circumstances of nations, and decrease unemployment and crime rates (Awotomilusi et al. 2023).

This article aims to explore the intricate relationship between the board gender diversity and the performance of enterprises in the European Union region. This entails analyzing the interaction between board gender diversity and liquidity. While controlling for board characteristics such as board size, independence, and board meetings in order to determine their impact on company performance. Furthermore, the study seeks to highlight deficiencies in existing literature and suggest practical ideas for businesses to align their board structures with company strategy in order to improve firm performance. This examination contributes to the existing research by providing a comprehensive analysis that examines several corporate governance characteristics and their interconnections. This helps to clarify the previously documented associations, which have often been vague in prior studies. This empirical work particularly assesses corporate governance using measures such as gender diversity, board independence, board size, and the number of board meetings while interacting board gender diversity with liquidity. It also takes into account company characteristics like leverage and firm size, as well as macroeconomic variables such as GDP and inflation.

The following sections of this study are organized as follows: Section 2 will present and discuss the underlying theoretical foundation and the hypothesis development based on the previous research. In Section 3, the research methodology will be presented and clarified. Section 4 contains the results and analysis. Finally, the research is concluded in Section 5.

2. Literature Review

2.1. Theoretical Background

2.1.1. Agency Theory

Agency theory posits that the makeup of a board of directors is vital in addressing the principal-agent problem and minimizing agency costs. Factors such as the presence of independent directors, gender diversity, an ideal board size, and regular board meetings all contribute to improving the board's capacity to properly oversee management (Pucheta-

Martínez and Gallego-Álvarez 2020). This enhanced supervision ensures that management decisions are in line with the interests of shareholders, therefore improving the performance of the company (Mishra and Kapil 2017). Gaining insight into these connections facilitates the development of corporate governance frameworks that foster responsibility, openness, and the generation of wealth for shareholders (Amedi and Mustafa 2020). Aligning long-term strategic objectives with shareholder interests reduces agency costs and offers a comprehensive strategy for value maximization (Al-Shaer et al. 2023). One of the critical mechanisms to mitigate agency problems is an effective board of directors. According to research, there is a connection between the board's abilities and company performance. (Al-Matari et al. 2012). Specifically, diversity in board composition, including gender and expertise diversity, has been shown to positively influence firm value (Awad et al. 2023). However, too large a board can be detrimental due to increased coordination costs and diluted responsibilities (Ghabayen 2012). Moreover, the value of a firm is not solely determined by corporate strategy but is also significantly influenced by the board's composition (Johl et al. 2015).

2.1.2. Resource Dependency Theory

The Resource Dependency Theory posits that the board of directors assumes a pivotal role in promoting the efficient allocation and supervision of resources within a business. According to Awad et al. (2023), the board of directors' organizational structure significantly influences the organization's capacity to develop and implement efficient business strategy. Furthermore, the traits of the board, such as its size and gender diversity, have an apparent impact on the overall assessment of the company (Assenga et al. 2018). The aforementioned citation underscores the significance of a comprehensive board selection procedure appropriate to extend the value of a company through strategic decision-making (Mishra and Kapil 2017). Consequently, resource dependency theory supports the careful consideration of board membership to improve business strategy and, therefore, the value of the enterprise. In addition, Varghese and Sasidharan (2020) claim that the composition of the board has a direct influence on the firm's capacity to adapt to changes in the market. The correlation between adaptability and enhanced financial performance is commonly observed, highlighting the importance of the board's engagement in resource allocation and strategy formulation. In addition, to effectively manage interdependencies with external stakeholders and so reduce possible risks and vulnerabilities, the board plays a critical role (Johl et al. 2015). The importance of a well-designed board in enhancing corporate strategy and company value is underscored by resource dependency theory (Hung et al. 2019).

2.1.3. Social Identity Theory

Social Identity Theory offers a persuasive structure for comprehending the favorable and unfavorable effects of gender diversity on corporate boards. Gender diversity has the capacity to improve the efficacy of boards and corporate governance (Knippenberg and Ginkel 2022). However, it can also bring about difficulties associated with in-group biases, communication obstacles, and longer decision-making procedures. It is essential to acknowledge these possible adverse effects in order to devise effective ways for managing diversity (Bradley 2020). Boards can achieve higher efficiency and better organizational outcomes by creating an inclusive atmosphere and resolving the causes of conflict. This allows them to take advantage of the benefits of gender diversity while reducing its disadvantages. Nevertheless, in contrast to the theories discussed before, social identity theory (Tajfel 1978) states that diversity negatively affects the unity and stability of a board, which can result in more disputes and differences among board members (Pelled et al. 1999). Specifically, diversity among the boards can lead to individuals categorizing themselves and others, resulting in adverse perceptions across different groups (Varouchas et al. 2023). This can ultimately have a detrimental impact on the general functioning of the board. Adusei and Obeng (2019) argue that board gender diversity reduces the technical

effectiveness of microfinance organizations. They suggest that heterogeneous groups face more communication disputes and hurdles compared to homogenous groups.

2.2. Previous Studies & Hypothesis Development

Gender Diversity & Firm Performance

The agency hypothesis posits that gender diversity in boardrooms significantly influences a firm's success. Al-Matari et al. (2012) and Al-Shaer et al. (2023) provide empirical support for the notion that a board composed of individuals from various backgrounds, especially including women, enhances business value by facilitating more effective decision-making and incorporating a wider range of perspectives. This particular variation is considered crucial in promoting the development of fresh ideas and establishing connections, hence reducing agency expenses and enhancing effective governance. Research conducted by Amedi and Mustafa (2020) and Assenga et al. (2018) indicates that female directors possess extensive educational qualifications and varied professional backgrounds, which enhance their capacity for making informed decisions. This aligns with the resource reliance hypothesis, which suggests that board members, especially women, can significantly enhance a firm's resources due to their distinct connections and networks. The research conducted by Awad et al. (2023) and Black and Kim (2012) demonstrates a positive correlation between boards that are varied in terms of gender and higher business value across different market circumstances. This finding reinforces the significance of gender diversity in contributing to corporate performance. The correlation between the diversity of board gender and the success of a corporation, however, is not always straightforward or good. Johl et al. (2015) and Ghabayen (2012) discovered contrasting outcomes, indicating that although gender diversity can have a positive impact on corporate value, it is not consistently guaranteed. Hung et al. (2019) and Kanakriyah (2021) contend that the benefits of gender diversity might vary based on factors such as the company's scale, sector, and management framework. In addition, Lei and Song (2012) and Mishra and Kapil (2018) argue that although gender diversity is beneficial, it should be complemented by other effective governance strategies in order to enhance business value. Pucheta-Martínez and Gallego-Alvarez (2020), Rodríguez-Fernández et al. (2014), and Salem et al. (2019) corroborate this perspective by illustrating that the influence of gender diversity on corporate performance is intricate and influenced by diverse external and internal factors. Therefore, Sobhan (2021) and Varghese and Sasidharan (2020) recognize the positive impact that gender diversity can have, but they stress that its effectiveness is contingent upon the broader circumstances of the company.

H1: *There is a relation between gender diversity and the firm's performance.*

Board Independence & Firm Performance

Board independence is a crucial element of corporate governance that has a substantial impact on the performance of a company. Al-Matari et al. (2012) and Al-Shaer et al. (2023) emphasize the significance of independent board members in enhancing the worth of a firm. The presence of independent directors is crucial since they offer unbiased oversight and provide strategic guidance that is not influenced by internal factors. Their role is particularly crucial in upholding effective governance and oversight, resulting in enhanced decision-making and risk mitigation. Amedi and Mustafa (2020) and Assenga et al. (2018) provide evidence to support the idea that companies with a higher proportion of independent directors tend to achieve better financial performance. The rise in numbers can be attributed to the independent directors' ability to provide impartial assessments and their lack of connections to the company's management, which minimizes any conflicts of interest and enhances the board's overall responsibility and transparency. The relationship between board independence and business performance, however, is intricate and influenced by a multitude of factors. Black and Kim (2012) and Johl et al. (2015) argue that board independence can have a positive impact on corporate value. However, the effectiveness of

board independence is contingent upon the specific circumstances of the firm, including factors such as its size, industry, and market conditions. Ghabayen (2012) and Hung et al. (2019) have identified that the benefits of board independence can vary across different geographical areas and economic sectors. Similarly, Lei and Song (2012) as well as Mishra and Kapil (2017) find that the impact of board independence on company value is intricate and interrelated with several governance indicators. Pucheta-Martínez and Gallego-Álvarez (2020) and Rodríguez-Fernández et al. (2014) emphasize the need to consider factors like board size, diversity, and directors' experience when evaluating the effectiveness of board independence. Both Salem et al. (2019) and Sobhan (2021) recognize that board independence has the potential to positively affect firm performance. However, they also emphasize that the relationship between board independence and firm performance is not simple and is influenced by various governance and contextual factors, as noted by Varghese and Sasidharan (2020).

H2: *There is a relation between board independence and the firm's performance.*

Board Size & Firm Performance

Multiple studies have shown that the size of a company's board of directors is a significant factor in determining its performance and worth. Resource dependence theory suggests that larger boards can enhance a company's interactions with its external environment, leading to an increase in firm value, as indicated by studies conducted by Al-Matari et al. (2012) and Al-Shaer et al. (2023). The extensive knowledge and networks of a more comprehensive board might be valuable in making strategic decisions and acquiring external resources. Research conducted by Amedi and Mustafa (2020) and Assenga et al. (2018) indicates that larger boards have a beneficial impact on a firm's financial performance due to the increased diversity of ideas and experiences they offer. Moreover, as stated by Black and Kim (2012) and Johl et al. (2015), selecting the right board size can positively impact governance and oversight, hence enhancing the overall performance of the company. These studies suggest that there is no universally applicable solution since the effectiveness of board size differs depending on the specific circumstances of the organization, such as its industry, corporate strategy, and market dynamics. Conversely, another study adopts a more subtle method for examining the connection between the size of the board and the profitability of a corporation. According to Ghabayen (2012) and Hung et al. (2019), larger boards can offer diverse perspectives and insights, but they can also lead to difficulties in coordination and decision-making, which may negatively impact company performance. Similarly, the studies conducted by Lei and Song (2012) and Mishra and Kapil (2018) reveal that having a board that is excessively large might result in inefficiencies, diluted accountability, and prolonged decision-making procedures. Pucheta-Martínez and Gallego-Álvarez (2020) and Rodríguez-Fernández et al. (2014) argue that while evaluating the effectiveness of a board, it is important to take into account factors such as board size, independence, diversity, and competency. Salem et al. (2019) endorse this perspective, and Sobhan (2021) acknowledges that although a larger board can offer unique perspectives and connections, its effect on company value is intricate and influenced by various internal and external circumstances, as highlighted by Varghese and Sasidharan (2020).

H3: *There is a relation between the number of board members (BS) and the firm's performance.*

Board Meetings and Firm Performance

Board meetings' frequency is a crucial element in corporate governance, often indicating the board's effectiveness and amount of involvement in managing the company. The frequency of board meetings can serve as a strong indicator of a board's attitude towards good governance and its ability to promptly address company-related concerns, as demonstrated by research conducted by Al-Matari et al. (2012) and Al-Shaer et al. (2023). Regular meetings enhance expeditious decision-making and effective supervision, both of which

are vital elements of sound governance and positively influence business performance. The efficacy of the board in supervising and offering guidance on business strategy is strongly associated with the frequency of board meetings, as demonstrated by Amedi and Mustafa (2020) and Assenga et al. (2018). This correlation has an impact on the effectiveness of the company's operations and its financial outcomes. Moreover, Awad et al. (2023) and Black and Kim (2012) have proposed that enhancing the frequency of board meetings can enhance governance procedures by ensuring more comprehensive and consistent oversight of management decisions. Nevertheless, the correlation between the frequency of board meetings and the performance of the company is not direct. According to Johl et al. (2015) and Ghabayen (2012), regular meetings can enhance monitoring, but too many meetings may suggest issues within the company, such as ineffective management or crises, which could result in poor investor opinions. Hung et al. (2019) and Kanakriyah (2021) propose that the impact on business value is determined by the quality of meetings rather than the number of meetings. According to Lei and Song (2012) and Mishra and Kapil (2017), the efficacy of board meetings is influenced by the makeup and skill set of the board members. Pucheta-Martínez and Gallego-Álvarez (2020) and Rodríguez-Fernández et al. (2014) assert that the ideal frequency of meetings should be established by considering the particular requirements and conditions of the company. This perspective is endorsed by Salem et al. (2019) and Sobhan (2021), who observe that the frequency of board meetings is influenced by factors such as the firm's size, industry, and governance structure, as also highlighted by Varghese and Sasidharan (2020).

H4: *There is a relation between the number of board meetings and the firm's performance.*

3. Research Methodology

3.1. Study Sample

The LSEG Data Analytics platform indicates that there are 8050 non-financial companies listed in Europe. This information was obtained from the publicly available financial accounts of these companies, spanning from 2011 to 2023. The chosen sample comprises non-financial enterprises, which represent a significant fraction of the total number of companies in these nations. Significantly, this investigation did not include any financial institutions. This exclusion arises from the unique asset structures of financial institutions, characterized by high leverage ratios and industry-specific requirements that are applicable only to the financial sector and not to other industries. The ultimate sample consisted of 8050 companies from all European countries, whereas 3793 were removed owing to data unavailability. Table 1 shows the sample breakdown by country.

3.2. Model Development

3.2.1. Dependent Variable: ROA

Research has demonstrated that return on assets (ROA) is a significant metric for evaluating a company's operational performance (Singh et al. 2024). This metric, increasingly prevalent in financial research, evaluates the efficiency with which a corporation can create profits from its portfolio of assets. The return on assets can be calculated by dividing a company's earnings by its total assets (Sotonye 2024). This ratio indicates the efficiency with which an organization utilizes its assets to generate profits. A higher return on assets ratio indicates that a company is efficiently utilizing its resources to generate profits, which is often seen positively by investors as an indication of future expansion and profitability (Naim and Aziz 2022). Conversely, a lower return on assets could suggest potential operational inefficiencies or underutilization of assets, which may reduce the attractiveness of the company to investors. This metric is crucial for investors and analysts seeking to comprehend not only a company's profitability but also its asset efficiency in order to enhance their investment decisions (Pucheta-Martínez and Gallego-Álvarez 2020).

Table 1. Sampling procedure.

Sampling Procedure	Description	Total Population	Sample Size
1-	All listed non-financial companies in all European countries	8050	-
2-	Data availability consideration	-	4257
3-	Selection of companies with data	-	4257
4-	Period covered	-	2011–2023
Country	Population	Final Sample	
Croatia	77	51	
Greece	156	93	
Macedonia	154	68	
Malta	44	16	
Republic of Montenegro	240	106	
Republic of Serbia	266	135	
Slovenia	108	76	
Spain	305	246	
Belgium	191	117	
Liechtenstein	4	2	
Bulgaria	250	164	
Czech Republic	26	9	
Hungary	87	55	
Poland	729	436	
Romania	357	196	
Russia	626	420	
Austria	70	14	
Slovak Republic	43	23	
Estonia	37	19	
Faroe Islands	3	1	
Iceland	29	18	
Republic of Ireland	97	46	
Latvia	14	7	
Lithuania	29	10	
Norway	301	172	
Sweden	963	412	
Denmark	166	46	
Finland	181	76	
France	665	218	
Germany	756	159	
Italy	447	137	
Luxembourg	94	34	
Netherlands	171	49	
Portugal	50	24	
Switzerland	314	163	
Total	8050	4257	

Authors' collection and analysis.

3.2.2. Independent Variable

Gender Diversity

Various authors, such as Gul et al. (2011), have contended that women have a significant role in the field of business management. This is because women contribute distinct ideals and criteria to their profession, which differ from those employed by men (Solimene et al. 2017). According to Seierstad (2016), female directors on boards are considered important for two reasons: firstly, because of their impact on the business model, and secondly, because of their contribution to social justice. The first perspective is grounded on the belief that including female directors on boards will bring in fresh expertise, which in turn will positively influence the performance of the company (Liu et al. 2013). The second perspective emphasizes the importance of creating diversity on boards of directors to ensure representation of all team members. The first premise of this research asserts that women directors on boards can offer distinct perspectives in decision-making processes compared to men, which can greatly benefit businesses (Hoobler et al. 2016).

3.2.3. Moderating Variable

Liquidity

This paper used the current ratio as a proxy for liquidity following Chandra et al. (2022) and Essel (2023). According to Nguyen et al. (2024) and Masood et al. (2016), a business's ratio of liquidity shows the capacity to transform assets into cash to cover debts and payments. In addition, Hoggett et al. (2018) argued that investors can assess the organization's short- and long-term liquidity and ability to cover liabilities using the liquidity ratio. Data et al. (2017) claimed that liquidity is a crucial indicator for assessing the stability and expansion of most companies; hence, it is imperative to effectively manage it. Hence, effective liquidity management plays a crucial role in determining the success or failure of a business. Omondi and Muturi (2013) assert that liquidity is essential for improving a company's success. Therefore, companies that maintain appropriate levels of liquidity can achieve superior performance by effectively balancing the trade-off between risk and return (Shahrour et al. 2024).

3.2.4. Board Control Variables

Board Independence

Independent directors are individuals who have no affiliation with the company's management. As a result, they are unlikely to impede business choices with their personal viewpoints (Agrawal and Knoeber 1996). Independent directors serve as a significant control tool for organizations due to their ability to make more impartial judgments compared to management and shareholders (Qadorah and Fadzil 2018). They also offer fresh perspectives that differ from the conventional viewpoints, which tend to prioritize financial matters (Zahra and Stanton 1988). According to Ibrahim and Angelidis (1995), independent directors often prioritize the interests of all stakeholders, as most companies are unlikely to withhold valuable information from their stakeholders. Moreover, independent directors are primarily concerned with ensuring the proper conduct of firms and the achievement of stated objectives (Masulis et al. 2012). Therefore, it is anticipated that independent directors will exhibit greater objectivity and independence while evaluating the management and conduct of the firms compared to executive directors (Sonnenfeld 1981).

Board Size

Several studies have documented a detrimental correlation between the size of a company's board and its overall success. According to Mak and Kusnadi (2005) and O'Connell and Cramer (2010), there is evidence to suggest that a larger board size is associated with lower firm performance. However, there have been only a limited number of studies that have demonstrated a favorable correlation between the size of a company's board and its success (Yermack 1996; Jackling and Johl 2009). When examining the correlation between

board size and company performance, it is observed that larger boards have an impact on firm performance (Naim and Aziz 2022). There is a noticeable decline in board size for improved firm performance, since managing and maintaining larger boards is challenging and costly for both the management and the firm. Various research has provided evidence for this claim. For example, Cheng et al. (2008) discovered a notable correlation between a smaller board size and improved business performance.

Board Meetings

According to Vafeas (1999), there is a negative relationship between the number of board meetings and firm value. This means that as board activity decreases, share values also decline. The frequency of board meetings has a negative impact on the performance of Malaysian listed corporations, as found by Johl et al. (2015). Other research has also discovered comparable adverse associations between the number of board meetings and the performance of the company. In contrast, only a small number of studies have indicated the favorable influence of the frequency of board meetings on the performance of a company. According to a study by Ntim and Osei (2011), it was revealed that the frequency of board meetings had a significant and favorable effect on firm performance.

3.2.5. Firm Control Variables

Leverage

The ratio of a firm's debts to assets, called leverage, affects its value (Awad et al. 2022). Al-Matari et al. (2012) and Al-Shaer et al. (2023) show that leverage affects corporate value in two ways. Leverage can boost a company's value by funding expansion and development. Effective leverage management helps optimize resource utilization and improve financial performance, according to Amedi and Mustafa (2020) and Assenga et al. (2018). Jensen (1993) believed that leverage can increase a company's value by reducing agency costs and improving resource efficiency. Moderate leverage may assist in balancing debt financing's pros and cons, according to Awad et al. (2023). Whether leverage and corporate value are positively associated is unclear. Johl et al. (2015) and Black and Kim (2012) say excessive leverage can hurt a company's finances, risk, and value. Hung et al. (2019) and Ghabayen (2012) concur that excessive leverage can raise interest rates and payback needs, affecting corporate performance and financial stability. Kanakriyah (2021) and Lei and Song (2012) state that leverage affects a company's value depending on its sector, market, and economy. Mishra and Kapil (2017) say a balanced capital structure boosts an organization's value. Leverage is useful, but Varghese and Sasidharan (2020) warn that it complicates a company's value and must be handled wisely. Salem et al. (2019) and Sobhan (2021) note that many factors, including company governance, industry dynamics, and the economy, affect how well leverage increases firm value.

Firm size

The logarithm of a company's total assets is a frequent size metric (Awad et al. 2024), and it affects performance and value. The enormous resources and variety of larger organizations make them more resilient to market risks and fluctuations, according to Al-Shaer et al. (2023) and Al-Matari et al. (2012). This resiliency often leads to higher firm values since larger organizations can negotiate better and boost profit margins. Due to their scale, Amedi and Mustafa (2020) and Assenga et al. (2018) indicate that large organizations are more likely to adopt detailed risk management frameworks, which improves their stability and profitability. Studies like Hung et al. (2019) and Kanakriyah (2021) suggest that economies of scale can help larger companies raise capital and increase profits. However, firm size and value are not always linear or positive. Studies by Mishra and Kapil (2017) and Lei and Song (2012) imply that greater sizes may lose their benefits. Larger organizations may lose agility or administrative efficiency due to market fluctuations, as stated by Rodríguez-Fernández et al. (2014), Pucheta-Martínez and Gallego-Álvarez (2020). Salem et al. (2019) and Sobhan (2021) show that firm size may not always provide value in different markets and industries. Varghese and Sasidharan (2020) add that the relationship

between size and value is complicated and contextual because the company's ownership structure and board makeup also affect its value.

3.2.6. Country Control Variables

GDP growth

Many financial economists' studies real GDP growth's impact on business value in various markets and industries. Businesses in economies with substantial GDP growth often enjoy value gains, according to Al-Shaer et al. (2023) and Al-Matari et al. (2012). Businesses develop and profit when economies grow because consumer spending, corporate investment, and market circumstances improve. Businesses benefit from GDP growth by increasing demand for their goods and services, according to Amedi and Mustafa (2020) and Assenga et al. (2018). Further research by Johl et al. (2015) and Black and Kim (2012) reveals that developing economies encourage enterprises to invest in innovation and expansion, increasing their market value. The relationship between company value and actual GDP growth may be difficult. Hung et al. (2019) and Kanakriyah (2021) noted that while economic growth might assist enterprises, management effectiveness, competitive tactics, and operational efficiency still matter. Lei and Song (2012) and Mishra and Kapil (2017) observe that GDP growth benefits certain industries more than others depending on the nature of economic expansion. Pucheta-Martínez and Gallego-Álvarez (2020) and Rodríguez-Fernández et al. (2014) emphasize the significance of considering internal and external elements, such as GDP growth, when assessing firm value. GDP development can provide a business-friendly environment, but market saturation and competitiveness still present challenges, according to Salem et al. (2019) and Sobhan (2021). Economic growth and business value are complicated and continually changing, according to Varghese and Sasidharan (2020). Global economic trends and policies also affect them.

Inflation

Numerous studies have examined how inflation affects market valuation and company success. Al-Shaer et al. (2023) and Al-Matari et al. (2012) examine how inflation impacts pricing and operating costs. These elements may affect a company's market value and profitability. High inflation may make it hard for firms to sustain profit margins due to increased labor and raw material expenses. However, mild inflation may promote spending and economic activity, benefiting companies. Amedi and Mustafa (2020) and Assenga et al. (2018) state that a firm's worth depends on its capacity to pass on rising prices to consumers without losing demand. According to Johl et al. (2015) and Black and Kim (2012), a firm's inflation exposure depends on its industry, with some industries more vulnerable to inflation. Ghabayen (2012) and Hung et al. (2019) state that inflation impacts interest rates, which affect how much a corporation borrows and invests, impacting its value. According to Kanakriyah (2021) and Lei and Song (2012), financial leverage and capital structure also mitigate inflation's impact on firm value. Kanakriyah (2021) and Lei and Song (2012) similarly claim that corporate capital structure and financial leverage moderate inflation's effect on firm value. Mishra and Kapil (2017) say businesses with good pricing power and cost management can mitigate inflation. Pucheta-Martínez and Gallego-Álvarez (2020) and Rodríguez-Fernández et al. (2014) suggest that inflation affects firm value mostly due to monetary policy reactions and the economy. Finally, Varghese and Sasidharan (2020) stress the importance of global economic trends when assessing inflation's impact on firm value, while Salem et al. (2019) and Sobhan (2021) argue that inflation's effects vary by market and economy.

3.3. Econometric Model

Several studies have examined the relationship between board characteristics and company success using various econometric techniques. This empirical paper applied the panel estimation method (fixed and random effect techniques) to investigate such a relation. This paper builds on the methods applied in previous research by Al-Matari

et al. (2012), Al-Shaer et al. (2023), and Amedi and Mustafa (2020). The panel form of the data, which includes both cross-sectional and time-series variables, makes this technique appropriate. These approaches were successfully used in the studies of Assenga et al. (2018) and Black and Kim (2012), and they have been recognized for their value in handling the complexity of the firm productivity data. Moreover, panel data analysis captures the dynamic relationship between board features like gender diversity, size, and company performance by allowing evaluation of both within and between data changes. This strategy is in line with research by Hung et al. (2019) and Kanakriyah (2021), which highlight the importance of considering impacts that are both firm- and time-specific. The panel regression approaches offer an improved comprehension of the influence of board features on firm value over time, as noted by Lei and Song (2012) and Mishra and Kapil (2017). Table 2 report further information about the variables of the study.

Table 2. Measurement variables.

Variable	Abbreviation	Measurement	Reference
Dependent Variable			
Firm Performance	ROA	EBIT divided by End-of-Year Total Assets	Al-Matari et al. (2012); Lei and Song (2012) and Mishra and Kapil (2017)
Independent Variables			
Gender Diversity	GD	Number of Female Board Members divided by Total Number of Board Members	Awad et al. (2023) and Pucheta-Martínez and Gallego-Álvarez (2020).
Moderator Variable			
Liquidity	Liq	Current Assets divided by Current Liabilities	Data et al. (2017) and Nguyen et al. (2024)
Board Control Variables			
Board Independence	IND	Percentage of Independent Board Members obtained from Refinitiv Eikon Platform	Al-Shaer et al. (2023); Rodríguez-Fernández et al. (2014) and Varghese and Sasidharan (2020)
Board Size	BS	Number of Board Members obtained from Refinitiv Eikon Platform	Al-Matari et al. (2012); Ghabayen (2012) and Mishra and Kapil (2018).
Board Meetings	BM	Number of Board Meetings per year obtained from Refinitiv Eikon Platform	Lei and Song (2012) and Pucheta-Martínez and Gallego-Álvarez (2020)
Firm Control Variables			
Leverage	LEV	End-of-Year Total Liabilities divided by End-of-Year Total Assets	Johl et al. (2015) And Hung et al. (2019)
Firm Size	FS	Natural Logarithm of Bank's End-of-Year Total Assets	Al-Shaer et al. (2023) and Mishra and Kapil (2017, 2018)
Country Control Variables			
GDP Growth	GDP	GDP Growth Rate	Lei and Song (2012) and Sobhan (2021)
Inflation Rate	INF	Annual Percentage of Consumer Price Index	Lei and Song (2012) and Sobhan (2021)

Model One (Baseline):

$$ROA_{i,t} = \beta_0 + \beta_1(GD_{i,t}) + \beta_2(IND_{i,t}) + \beta_3(BS_{i,t}) + \beta_4(BM_{i,t}) + \beta_5(LEV_{i,t}) + \beta_6(FS_{i,t}) + \beta_7(Liq_{i,t}) + \beta_8(GDP_t) + \beta_9(INF_t) + \varepsilon$$

Model Two (Interaction Model):

$$ROA_{i,t} = \beta_0 + \beta_1(GD_{i,t}) + \beta_2(IND_{i,t}) + \beta_3(BS_{i,t}) + \beta_4(BM_{i,t}) + \beta_5(LEV_{i,t}) + \beta_6(FS_{i,t}) + \beta_7(Liq_{i,t}) + \beta_8(GDP_t) + \beta_9(INF_t) + \beta_{10}(GD_{i,t} * Liq_{i,t}) + \varepsilon$$

4. Results, Analysis, and Discussions

4.1. Descriptive Statistics

The below Table 3 presents the descriptive statistics for the variables, offering a detailed summary of the important factors. Descriptive statistics offer a more comprehensive understanding of how variables are distributed by examining the measures of central tendency, variability, and range within the dataset (Lei and Song 2012). The dependent variable ROA has been found to have a mean value of 0.031 and a standard deviation of 0.096. Furthermore, the dependent variable has a substantial range of values, ranging from -0.526 to 1.265 , indicating a notable fluctuation in the return on assets of companies over time.

Table 3. Descriptive statistics.

Variables	Mean	Std. Dev	Min	Max
ROA	0.031	0.096	-0.526	1.265
GD	0.215	0.085	0.00	0.568
IND	0.562	0.163	0.00	0.865
BS	10.124	1.562	2.00	24.00
BM	9.185	1.346	2.00	26.00
Liq	1.15	0.062	0.754	3.284
LEV	0.396	0.146	0.109	0.915
FS	19.865	1.967	6.452	27.749
GDP	0.019	0.045	-0.095	0.075
INF	0.025	0.026	-0.086	0.079

Furthermore, the gender diversity (GD), which has an average value of 0.215, indicates that, on average, 22% of the board members in the firms are women. The board independence (IND) average of 0.562 indicates that a significant proportion of board members are independent. The standard deviation of the board size of 1.562 suggests a substantial variation among the organizations. In addition, the average number of board meetings (BM) each year is 9.185, suggesting that there are approximately 9 meetings per year in the frequency of board meetings. This finding aligns with the study conducted by Pucheta-Martínez and Gallego-Álvarez (2020). Regarding the control variables, the variable leverage (LEV) has an average value of 0.396, which represents that European companies on average tend to finance 39.6 percent of their assets through debt. The standard deviation of firm size (FS) is 1.967; this indicates the range of sizes among the organizations included in the sample. The national control variables show a low average for GDP growth (RGDP) at 0.019, indicating the limited growth in the nations included in the study.

4.2. Correlation Analysis

The below Table 4 displays the correlation table that provides an overview of the relationships between the variables. A moderately positive connection between the dependent variable and gender diversity among enterprises has been noted. According to Al-Shaer et al. (2023), there is a positive correlation between the proportion of female members on a company's board and its profitability. Furthermore, it is worth noting that there is a strong positive correlation of 0.125 between board diversity and the dependent variable. This also demonstrates that a higher level of board diversity is positively correlated with a firm's profitability.

Table 4. Correlation matrix analysis.

Variables	ROA	GD	IND	BS	BM	Liq	LEV	FS	GDP	INF
ROA	1.00									
GD	0.125 ***	1.00								
IND	0.086 ***	0.046 **	1.00							
BS	0.136 ***	0.147 ***	0.076 ***	1.00						
BM	−0.024	0.029	0.096 ***	0.074 ***	1.00					
Liq	0.038 **	0.041 ***	0.020	0.057 **	0.063 **	1.00				
LEV	−0.068 ***	0.049 ***	0.044 ***	0.136 ***	0.046 ***	−0.041 *	1.00			
FS	0.146 ***	0.037	0.029	0.074 ***	0.039	0.066 **	0.086 ***	1.00		
GDP	0.012	0.086 ***	0.079 **	0.009 ***	−0.016	0.024	−0.026	−0.016	1.00	
INF	0.019	0.074 ***	0.103 ***	0.085 ***	0.061	0.014	−0.024	0.034	0.135 ***	1.00

Note: ***, **, and * show statistical significance at 1%, 5%, and 10%, respectively.

Board diversity and independence positively correlate to the ROA; however, a bigger board size is negatively correlated with the ROA. Another observation derived from the correlation matrix is that there is a significant negative correlation of -0.068 between the dependent variable and the firm's leverage. This demonstrates that when the firm's leverage increases, the firm's ability to maximize its profit potential decreases. The data show a significant positive association between board size and ROA. High multicollinearity among variables can greatly affect the stability and reliability of regression analysis (Al-Shaer et al. 2023). Regression analysis must consider the Variance Inflation Factors to assess the level of multicollinearity among the variables. The variables in this study have a Variance Inflation Factor (VIF) of 1.39, indicating minimal presence of multicollinearity among the variables. A Variance Inflation Factor (VIF) exceeding five suggests a substantial presence of multicollinearity in the dataset (Awad et al. 2024).

4.3. Regression Results and Discussions

Table 5 displays the results of the panel regression analysis conducted using ROA as the dependent variable and the independent factors. The F-statistic of 89.640 indicates that the regressed model is fit. Furthermore, the R-squared value of 0.6029 signifies that 60.29% of the variation in the dependent variables can be accounted for by the independent variables in the regression. The strong explanatory power demonstrates the usefulness of the selected factors in capturing the fluctuations in the dependent variable, as stated by Varghese and Sasidharan (2020). The Hausman test assesses the efficacy and suitability of fixed effects, as demonstrated by Lei and Song (2012). The chi-squared value of 146.765 is at a statistically significant level of 1%, showing that the fixed effects model is better suitable than a random effects model. This suggests that there are unchanging and unobserved elements that have an impact on the dependent variable, which supports the application of fixed effects.

The results confirm a significant positive association between the diversity of board gender and firm performance. The variable representing the proportion of female directors on boards has a positive association and is statistically significant. Several studies, such as Liu et al. (2013) and Kılıç and Kuzey (2016), give strong evidence that the participation of women on the board can result in improved firm performance. The results of our study indicate that including minority groups, such as female directors, on corporate boards can effectively represent and safeguard the demands and interests of shareholders (Webb 2004). This is achieved through the demonstration of impartial and discerning decision-making, which can potentially lead to improved performance of the company (Terjesen et al. 2016). Improved performance can also be attributed to the increased board independence that female directors bring (Awad et al. 2023). This is because directors with more traditional

backgrounds typically do not raise the questions that may arise from directors of different ethnicities, cultural backgrounds, or genders, as argued by Carter et al. (2003). In addition, the presence of women on boards can bring a range of different perspectives and ideas to talks, resulting in policies that are more adaptable and inclusive (Nielsen and Huse 2010). This can lead to greater participation in the decision-making process and foster a more democratic approach to decision-making (Naim and Aziz 2022). Furthermore, the regression study has demonstrated a significant relationship between board independence and return on assets (ROA). This is in reference to the research carried out by Al-Shaer et al. (2023) and Rodríguez-Fernández et al. (2014). Therefore, the regression analysis demonstrates a favorable correlation between board independence and firm profitability (Awad et al. 2023). It is recommended that companies prioritize enhancing the board structure to increase its independence (Varghese and Sasidharan 2020).

Table 5. Fixed-effect panel regression results.

Dependent Variable (ROA)						
Model 1			Model 2			Mean VIF
Variable	Coefficient	Significance	Coefficient	Significance	VIF	
GD	0.056	0.001	0.062	0.000	1.49	1.39
GD* Liq			0.054	0.000		
IND	0.028	0.052	0.035	0.025	1.65	
BS	0.061	0.048	0.049	0.029	1.27	
BM	0.032	0.125	0.054	0.162	1.34	
Liq	0.052	0.026	0.074	0.000	1.48	
LEV	−0.074	0.000	−0.058	0.000	1.20	
FS	0.118	0.000	0.095	0.000	1.46	
GDP	0.109	0.084	0.095	0.059	1.35	
INF	0.529	0.162	0.448	0.152	1.31	
Constant	1.316	0.018	1.739	0.011		
F-statistics	96.513	0.000	106.289	0.000		
R-squared	0.621		0.659			
Hausman Test (χ^2)	138.168 (0.000)		152.855 (0.000)			

Authors' analysis.

The results illustrate a direct relationship between the size of the board and the performance of the firm. This research demonstrates that the size of a company's board has a significant impact on its value. Larger boards have a favorable effect on the company's profitability (Rodríguez-Fernández et al. 2014). Boards that include a large number of directors can contribute valuable human and social resources to the board. This is because they can bring a wide range of past experiences, talents, and professional backgrounds, as well as knowledge from related industries. This will be advantageous for the decision-making process (Pucheta-Martínez and Gallego-Álvarez 2020). Furthermore, CEOs or managers will have greater complexity in exerting pressure on directors within a larger board. Therefore, the size of the board has a significant influence on overseeing the management team and providing guidance and counsel, as suggested by Klein (1998) or Singh et al. (2024), which ultimately leads to improved company performance.

Regression analysis shows that a firm's leverage negatively affects its profitability. The −0.098 coefficient at 1% significance indicates a statistically significant negative relationship between business leverage and profitability. Thus, the more debt a corporation takes on, the less it can maximize profits (Alsaed 2006). The inverse correlation between leverage and

profitability can be clarified using diverse theoretical frameworks and is substantiated by empirical evidence (Khalaf et al. 2023b). The trade-off theory emphasizes the equilibrium between the advantages of tax benefits and the disadvantages of bankruptcy expenses, whereas the pecking order theory underscores enterprises' tendency towards utilizing internal funding (Abu Khalaf and Awad 2024). Agency theory examines how the use of debt affects the actions of managers and their choices regarding investments. Empirical research regularly demonstrates that a high level of debt is linked to financial difficulties, less investment, and decreased profitability (Awad et al. 2024). Comprehending this connection is vital for companies to make optimal decisions about their capital structure, which in turn improves long-term profitability and value generation (Alshaiba and Abu Khalaf 2024).

In addition, firm size boosts success due to market power, economies of scale, and resource access (Abu Khalaf et al. 2024). As production volume increases, economies of scale lower per-unit manufacturing costs for larger firms. Profit margins may increase due to this cost advantage (Ahmed et al. 2023). Larger companies likewise possess more market power, allowing them to negotiate better supplier arrangements and raise pricing, increasing revenue. They also have more money for R&D, marketing, and other profit-boosting strategies (Awad et al. 2023). Larger organizations additionally possess varied product lines and income streams, reducing risk and stabilizing profitability. These qualities help firm size boost profitability (Khalaf et al. 2023a).

Finally, results show a significant positive impact of macroeconomic variables on European nonfinancial companies' profitability. Specifically, GDP increases profitability since it indicates economic health and activity (Khalaf et al. 2023b). GDP growth indicates an increasing economy, which boosts consumer spending, company investments, and product demand (Abdelazim and Khalaf 2024). Regarding enterprises, economic expansion increases sales and revenue because consumers and businesses have more disposable income (Abdullah et al. 2024). A strong GDP growth frequently leads to reduced unemployment, better wages, as well as higher consumer confidence that boosts demand. This higher demand might boost firm profits. In a booming economy, lower interest rates and fiscal stimulus cut costs and enhance profit margins for businesses. Therefore, increased GDP fosters company expansion and profitability (Sobhan 2021).

4.4. Robustness of Results

This section employs panel regression with different measurements to assure the reliability and stability of the findings; in specific, the dependent variable used is return on equity. In addition, GMM regression has been applied to check the robustness of results. GMM regression is a resilient and adaptable technique that provides notable benefits in addressing endogeneity, managing panel data, and producing efficient estimates in complicated circumstances. This methodology enables us to consider potential biases and offer a thorough comprehension of the connections between the variables. The robustness checks provide confirmation of the results' validity, suggesting that the observed consequences are not influenced by particular model specifications or methodological choices, as evident in the below Table 6.

Table 6. GMM regression results.

Variable	Model 1		Model 2	
	Coefficient	Significance	Coefficient	Significance
GD	0.063	0.000	0.071	0.000
GD* Liq			0.060	0.000

Table 6. Cont.

Variable	Model 1		Model 2	
	Coefficient	Significance	Coefficient	Significance
IND	0.034	0.044	0.052	0.001
BS	0.072	0.039	0.040	0.015
BM	0.038	0.155	0.063	0.121
Liq	0.057	0.015	0.079	0.000
LEV	−0.079	0.000	−0.066	0.000
FS	0.132	0.000	0.072	0.000
GDP	0.128	0.050	0.088	0.042
INF	0.425	0.193	0.355	0.186
Constant	1.288	0.142	1.529	0.158
Hansen Test	0.596		0.628	
AR (1)	0.366		0.426	
AR (2)	0.305		0.396	

5. Conclusions

This study investigated the association between the characteristics of corporate boards and return on assets (ROA), specifically focusing on non-financial corporations that are listed in Europe. The research was conducted using data from 4257 enterprises listed on the LSEG Data and Analytics portal from 2011 to 2023. The study employed panel regression models (fixed and random effects) to examine the impact of gender diversity, board independence, board size, and frequency of board meetings on the performance of companies, measured by return on assets. Additionally, the study included several control variables such as firm size, leverage, real GDP growth, and inflation rate. The Hausman test, a statistically significant test, verified the fixed effect hypothesis, yielding relevant results. The findings of our study emphasize the importance of different perspectives in corporate governance. We demonstrate that having a diverse gender composition and independent board members positively influences a company's performance and profitability. It is worth noting that although an enlarged board did not have a significant impact on business value, there was insufficient statistical evidence to establish a positive correlation between the frequency of board meetings and firm performance. Moreover, the impact of control variables on the valuation of the business was significant, encompassing aspects such as the size of the organization and its leverage. The intricate nature of external economic influences on business performance is exemplified by the less apparent effects of macroeconomic factors such as real GDP growth and inflation rate. Ultimately, this study adds to the growing body of scholarly literature on corporate governance and business performance by offering fresh insights into how board qualities impact profitability in the European context. The findings highlight the importance of the membership of the board and the methods for governing in improving business success. This has practical implications for policymakers and corporate executives. Our study has certain limitations, namely that it solely examined enterprises within the European Union within a specified timeframe. Consequently, the findings cannot be generalized universally. Furthermore, variables such as disparities in industrial sectors may impact the outcomes.

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Article

Liquidity Risk Mediation in the Dynamics of Capital Structure and Financial Performance: Evidence from Jordanian Banks

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Abstract: Maximising financial performance while maintaining adequate liquidity is a crucial and ongoing challenge for bank management, particularly in emerging markets. This study focuses on the relationship between capital structure and financial performance in Jordanian banks, with the mediating role of liquidity risk. Using panel data from 13 central Jordanian banks over the 2015–2022 period, we employ structural equation modelling (SEM) to analyse how capital structure ratios (equity-to-asset, debt-to-loan, and deposit-to-asset) influence financial performance metrics (return on assets and net income-to-expenditure ratio). Our findings reveal a significant positive association between capital structure and financial performance. However, liquidity risk fully mediates this effect. Capital structure primarily impacts performance by influencing a bank's liquidity risk profile. Furthermore, the strength of this mediating effect is noteworthy—capital structure exhibits a statistically more robust association with liquidity risk than its direct impact on performance. This highlights the crucial role of managing liquidity risk within the complex dynamics of bank operations. This research makes a significant contribution to the existing literature by demonstrating the positive impact of capital structure on performance using the underlying mechanism through which this effect occurs. The insights of this research provide several implications for practice in the context of banking industries.

Keywords: capital structure; financial performance; liquidity risk; emerging markets; banking sector; structural equation modelling

JEL Classification: G01; G32; G41

1. Introduction

Financial economics continues to scrutinise the intricate dynamics of banking sector performance. At the heart of this complex system lie three critical variables: capital structure, liquidity risk, and financial performance. These elements form a triad of interdependent factors that collectively shape banking institutions' stability, efficiency, and profitability worldwide (Berger and Bouwman 2013; Phuong et al. 2015; Sasso 2016).

Capital structure, the mix of debt and equity used to finance a bank's operations, is the foundation for banking activities. It determines a bank's funding costs and influences its risk-bearing capacity and regulatory compliance (Banna and Alam 2021; Boshnak 2023; Gropp and Heider 2010). Capital structure remains a subject of ongoing debate, with competing theories, such as the trade-off theory and the pecking order theory, offering different perspectives on how banks should balance debt and equity to maximise value (Bataineh 2021; Myers 2001).

Inextricably linked to capital structure is liquidity risk, which refers to a bank's ability to meet its short-term obligations without incurring unacceptable losses (Chen et al. 2021;

Diamond and Rajan 2001). Liquidity risk management has gained prominence in the post-2008 financial crisis era, with regulators and bank managers recognising its critical role in maintaining financial stability (Basel III 2013). The relationship between capital structure and liquidity risk is complex and bidirectional. In contrast, higher capital levels can provide a buffer against liquidity shocks, and the need to maintain liquidity can also influence a bank's capital structure decisions (Distinguin et al. 2013; Rout et al. 2021).

Financial performance, the third vertex of this triad, is the ultimate measure of a bank's success in navigating the challenges posed by capital structure decisions and liquidity risk management. Commonly assessed through metrics such as return on assets (ROA), return on equity (ROE), and net income-to-expenditure ratio (NIER), financial performance reflects a bank's ability to generate profits while managing risks and meeting regulatory requirements (Athanasoglou et al. 2008; Dey et al. 2023). The pursuit of solid financial performance must be balanced against prudent risk management and long-term stability, creating a complex optimisation problem for bank managers (Altunbas et al. 2007; Isanzu 2017).

The interrelationships among these three variables form a dynamic system central to understanding bank behaviour and performance. Capital structure decisions influence both liquidity risk and financial performance; liquidity risk management affects capital allocation and profitability; and financial performance outcomes feed back into capital structure and liquidity management strategies (Berger and Bouwman 2009). This complex web of interactions is further complicated by the unique characteristics of emerging markets, where institutional frameworks, regulatory environments, and economic conditions can differ significantly from those in developed economies (Khan et al. 2020; Naceur and Omran 2011).

In the context of emerging markets, the banking sector plays an even more crucial role in economic development, acting as the primary conduit for capital allocation and financial intermediation (Beck et al. 2010). The commercial banking sector, in particular, is a vital funding source for various economic sectors and development projects. However, banks in these markets face unique challenges in balancing profitability and risk management, and particularly in liquidity risk (Hunjra et al. 2020).

With its strategically essential and relatively stable banking sector, Jordan provides an ideal setting for examining these relationships in an emerging market context. The Jordanian banking sector has undergone significant reforms and modernisation efforts in recent years, making it a fascinating case study for investigating how capital structure, liquidity risk, and financial performance interact in a rapidly evolving financial landscape (Al-Shrari 2023; Al-Homaidi et al. 2019). By focusing on this market, we can gain valuable insights that may apply to other emerging economies grappling with similar challenges in balancing growth, profitability, and risk management.

Despite the growing body of research on these topics, a consensus on how capital structure influences financial performance in the banking sector remains elusive, particularly in emerging markets. This lack of agreement underscores the complexity of the relationships at play and highlights the need for further investigation. Moreover, the potential mediating role of liquidity risk in this relationship has been largely unexplored, presenting a significant gap in our understanding of bank financial dynamics (Le and Pham 2021).

This study addresses these gaps by investigating the complex relationships between capital structure, liquidity risk, and financial performance in Jordanian commercial banks. Our research examines the direct impact of capital structure on financial performance while also analysing the mediating role of liquidity risk in this relationship. By doing so, we aim to provide empirical evidence that can inform banking practices and regulatory policies in Jordan and similar emerging markets.

The significance of this research lies in its potential to enhance our understanding of how banks can optimise their capital structures to improve financial performance while effectively managing liquidity risk. By elucidating these relationships, we contribute to the ongoing debate on bank capital regulation and offer practical insights for bank managers

and policymakers in emerging markets (Bataineh 2021; Neville and Lucey 2022). Furthermore, our study employs advanced statistical techniques, including structural equation modelling (SEM), to provide a more nuanced analysis of the complex interrelationships between these variables. This methodological approach allows us to capture both direct and indirect effects, offering a more comprehensive picture of the financial dynamics at play in the banking sector (Kline 2023).

Our research is particularly timely given the ongoing challenges faced by the global banking sector, including the aftermath of the COVID-19 pandemic and increasing regulatory pressures. Focusing on the Jordanian banking sector, we provide a case study that can offer valuable lessons for other emerging markets facing similar challenges. The insights gained from this study can help banks in these markets better navigate the complex interplay between capital structure decisions, liquidity risk management, and financial performance optimisation.

Based on the outcomes of 13 Jordanian banks from 2015 to 2022, this research reveals a significant positive association between capital structure and financial performance, and this relationship is fully mediated by liquidity risk. Capital structure primarily impacts performance by influencing a bank's liquidity risk profile. This highlights the crucial role of managing liquidity risk within the complex dynamics of bank operations.

In the subsequent sections of this paper, we will delve into a comprehensive review of the relevant literature, develop our hypotheses based on existing theories and empirical evidence, describe our rigorous methodology, present our findings, and discuss their implications for both theory and practice in the field of banking and finance. This structured approach aims to contribute meaningful insights to the ongoing discourse on bank financial management and provide a solid foundation for future research in this critical area.

2. Literature Review and Hypothesis Development

2.1. Theoretical Framework

This study is grounded in two primary theories: the trade-off theory and the pecking order theory. These theories provide a solid foundation for understanding the relationships between capital structure, liquidity risk, and financial performance in the banking sector.

The trade-off theory, proposed by Kraus and Litzenberger (1973), suggests that firms balance the benefits of debt financing (such as tax shields) against the costs (such as financial distress and bankruptcy costs). In the context of banks, this theory implies that there is an optimal capital structure that maximises firm value by balancing the benefits of debt against its costs.

The pecking order theory, developed by Myers and Majluf (1984), posits that firms have a hierarchy of financing preferences. They prefer internal financing to external financing and debt to equity when external financing is required. This theory is particularly relevant to banks, as it helps explain their capital structure decisions about liquidity management and financial performance.

These theories provide a framework for understanding how banks make capital structure decisions and how these decisions impact their liquidity risk and financial performance.

2.2. Capital Structure and Financial Performance

Banks' capital structure decisions directly impact profitability and are central to their financial strategy (Suryani and Nadhiroh 2020; Velnampy and Nireesh 2012). Banks often balance debt and equity in their capital structure. Debt can be beneficial in optimising capital structure, reducing agency costs, and realising tax benefits (Al-Najjar and Taylor 2008). Therefore, the blend of debt and equity is critical in shaping a bank's capital structure and maximising financial efficiency and overall performance.

The pecking order theory suggests that external funding should be prioritised through debt when internal funds are insufficient. This is because the tax deductions resulting from interest payments offer significant benefits (Brealey et al. 2008; Sudana 2015). Capital structure reinforces recapitalisation by fulfilling banks' requirements by augmenting

the minimum paid-up capital. It enables banks to enhance operational efficiency and effectiveness in customer interactions (Saleh and Abu Afifa 2020).

Studies have proposed theories predicting the impact of bank capital structure on financial performance, with varying outcomes. Lee and Hsieh (2013) analysed the relationship between banks' capital structure and profitability across 42 Asian countries, finding that Middle Eastern banks had the most significant positive impact on financial performance. Iannotta et al. (2007) found a significant and positive association between capital and banks' profitability, attributing this correlation to factors including superior bank management quality and lower bankruptcy costs.

However, this understanding of capital's influence on profitability is not universally held. Naceur (2003) uncovered evidence suggesting capital may adversely impact bank profitability. Additional research conducted by Velnampy and Nireesh (2012) further supports this alternate viewpoint, highlighting a negative correlation between bank capital structure and performance.

Recent research by Oanh et al. (2023) using a Bayesian approach has provided new insights into how capital structure affects bank performance. Their findings emphasise the complex nature of this relationship and suggest that other factors, including liquidity, may moderate the impact of capital structure on performance.

Considering these divergent findings, scholars such as Berger and Bouwman (2009) and Anarfo (2015) have called for further exploration into the relationship between bank capital structure and profitability. Thus, we propose the following hypothesis:

Hypothesis (H1). *Banks' capital structures in the Jordanian banking sector significantly impact their financial performance.*

2.3. Capital Structure and Liquidity Risk

Banks act as intermediaries to mitigate information asymmetry and reduce transaction costs between borrowers and lenders (Parvin et al. 2020). This function addresses market imperfections arising from divergent perceptions between borrowers and lenders, which can result in a moral hazard or adverse selection (Khaldi and Hamdouni 2018).

Diamond (1984) shows that banks generate liquidity to meet depositors' withdrawal requirements. Banks transfer risk using riskless deposits to fund risky investment portfolios and earn profits through risk transfer (Mairafi et al. 2018). Banks may maintain sufficient liquidity to meet their immediate obligations.

According to Diamond and Rajan (2000), augmenting bank capital can reduce liquidity and facilitate banks' maintaining financial stability, thereby avoiding potential financial difficulties. Acosta-Smith et al. (2020) propose that a bank's capital influences liquidity risk via two pathways: capital's role in absorbing losses and as a catalyst prompting banks to reconfigure their capital structure for more effective liquidity risk management.

Several empirical studies have shed light on the principal determinants of bank liquidity risk, confirming a positive relationship between liquidity risk and the financial performance of banks. These determinants include bank size, capital adequacy, and financial leverage (Akhtar et al. 2011; Al-Harbi 2017). However, offering a different perspective, studies by Burksaitiene and Draugele (2018) and Sumani and Roziq (2020) indicate that capital structure wields a significant influence over liquidity risk, independent of the traditionally recognised factors.

Boamah et al. (2023) further contribute to this discussion by examining the interplay between capital regulation, liquidity risk, and bank performance in emerging economies. Their findings underscore the importance of considering liquidity risk when studying the relationship between capital structure and bank performance.

Thus, we propose the following hypothesis:

Hypothesis (H2). *The capital structure of banks in the Jordanian banking sector significantly impacts liquidity risk.*

2.4. Liquidity Risk and Financial Performance

Banks face significant liquidity risk (Arif and Nauman Anees 2012). Such factors negatively impact banking performance and deter existing and potential clients from engaging with the bank (Saleh and Abu Afifa 2020). Liquidity risk emerges from insufficient requisite liquidity to meet short-term debts and unpredictable expenses (Dey et al. 2023).

Bourke (1989) studied banks' profitability and causes, revealing that banks with better liquidity generate higher profits. Rahman and Saeed (2015) established a positive correlation between bank performance and liquidity risk, indicating that banks must increase their liquidity to enhance their efficacy. Chen et al. (2018) investigated the drivers of liquidity risk and how that risk relates to bank profitability. The findings demonstrated that increased liquidity lowers bank profitability as measured by ROA and ROE.

The impact of liquidity on performance has been the subject of several research studies (Claeys and Vander Vennet 2008; Trujillo-Ponce 2013). The outcomes have been varied. According to several studies, decreasing liquidity risk favours a bank's financial performance (Bordeleau and Graham 2010; Bourke 1989; Lartey et al. 2013). Some have found the reverse true (Alim et al. 2021; Konadu 2009).

Ruziqa (2013) provides valuable insights into this relationship in the context of Indonesian banks, finding that both credit and liquidity risks significantly influence bank financial performance. This study emphasises the importance of considering multiple risk factors when examining bank performance.

Thus, we propose the following hypothesis:

Hypothesis (H3). *Banks' liquidity risk in the Jordanian banking sector significantly impacts their financial performance.*

2.5. The Mediating Role of Liquidity Risk between Capital Structure and Financial Performance

Prior studies have discussed the nexus between capital structure and financial performance (Chadha and Sharma 2015; Nelson and Peter 2019; Saeed et al. 2013; Zeitun and Tian 2014). Some scholars have emphasised the direct impact of capital structure on financial performance (Das and Swain 2018; Pinto et al. 2020; Vätavu 2015). Alternatively, some scholars have argued that capital structure does not always impact firm performance directly, but indirectly improves performance through mediating and moderating factors (Ahmed et al. 2023; Aslam et al. 2014; Ronoowah and Seetanah 2024; Shahwan 2018).

In this study, we proposed that liquidity risk is an essential conduit that plays a mediating role between capital structure and financial performance. While direct relationships between capital structure, liquidity risk, and financial performance have been established in previous research, the mediating role of liquidity risk in this relationship is a relatively unexplored area. Acosta-Smith et al. (2020) propose that a bank's capital influences liquidity risk via two pathways: capital's role in absorbing losses and as a catalyst prompting banks to reconfigure their capital structure for more effective liquidity risk management. Capital structure is a crucial factor which has a significant influence over liquidity risk (Sumani and Roziq (2020). Bank risk is considered a key channel through which intellectual capital influences financial performance (Cahyaningrum and Atahau 2020). In addition, liquidity risk management mediates the path between the liquidity factors and performance of UAE Islamic banks (Alqemzi et al. 2022). Boamah et al. (2023) found that liquidity risk mediates the relationship between capital regulation and bank performance, suggesting that the impact of capital structure on performance is not direct but operates through its effect on liquidity risk. Moreover, liquidity risk and credit jointly influence bank financial performance (Ruziqa (2013). Thus, this study proposes that liquidity risk might act a mediating mechanism through which the capital structure impacts the financial performance of Jordanian banks. Based on this empirical foundation, we propose the following hypothesis:

Hypothesis (H4). *Liquidity risk mediates the relationship between capital structure and financial performance in the Jordanian banking sector.*

The study's proposed research framework, incorporating these relationships and control variables, is depicted in Figure 1.

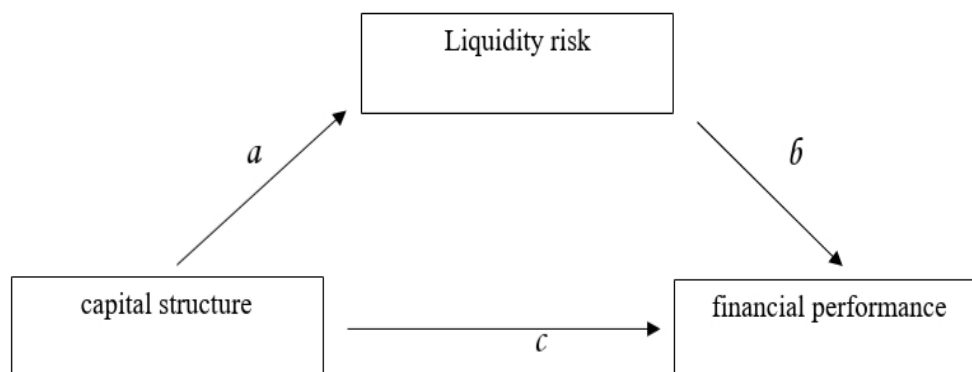


Figure 1. Research framework.

3. Methodology

3.1. Population and Sample

This study employs a quantitative approach to investigate how capital structure affects financial performance and how liquidity risk mediates this connection, utilising secondary data from financial reports of Jordanian banks. The population consists of 25 Jordanian banks (Central Bank of Jordan n.d.), from which we selected a sample of 13 commercial banks over eight years (2015–2022). There are two reasons to focus on the financial industry over traditional non-financial firms. First, financial industries are highly concerned with mitigating risk and capital structure. Hence, they are always concerned with risk mitigating strategies to enhance their operations. However, on the other hand, non-financial firms are keenly focusing on competitive advantage, reputation, and growth (Anwar 2018; Ullah et al. 2023).

The focus on Jordanian banks is justified by the sector's crucial role in the country's economy and its resilience amid regional instabilities. This geographical limitation allows for a more controlled study environment, minimising the impact of varying regulatory frameworks and economic conditions across different nations. Furthermore, Jordan's banking sector has undergone significant reforms in recent years, making it an interesting case study for understanding capital structure dynamics and financial performance.

Our sample of 13 banks was carefully selected based on the availability of consistent and complete financial data for the entire study period. Due to their unique regulatory structures and operating models, we excluded foreign and Islamic banks, focusing instead on commercial banks to ensure comparability. This sample represents over 50% of the total population and is considered representative in financial studies (Krejcie and Morgan 1970).

The study period of six years (2015–2020) was chosen to balance the need for a comprehensive dataset with the requirement for recent and relevant information. This timeframe captures a significant period of economic development and regulatory changes in Jordan's banking sector, allowing for meaningful analysis of trends and relationships. The resulting 78 bank–year observations ($N = 78$) provide a robust dataset for our analysis.

While a larger sample size or more extended period might be preferable in some contexts, our sample of 78 observations is well justified. The sample covers more than half of the Jordanian banking sector, ensuring high representativeness. By focusing on a carefully selected sample and period, we ensure the consistency and completeness of our data, which is crucial for reliable analysis. Using panel data allows us to exploit cross-sectional and time-series variations, partially mitigating the limitations of sample size (Baltagi 2015).

From a statistical standpoint, our sample size of 78 is sufficient to detect medium to large effect sizes with adequate statistical power in our analyses, including regression analysis and structural equation modelling (Cohen 2016). Moreover, our sample size is

comparable to, and in some cases more significant than, those used in published studies focusing on banking sectors in individual countries (Berger and Bouwman 2013).

3.2. Data Collection

Data collection involved gathering financial information from the selected banks' annual reports, publicly available through the Amman Stock Exchange and the banks' official websites. We also cross-referenced these data with information from the Central Bank of Jordan to ensure accuracy and consistency, thereby enhancing the reliability of our dataset.

3.3. Measuring Variables

3.3.1. Dependent Variable

In this study, to measure the dependent variable (bank financial performance), two proxies were used: return on assets (ROA) and net income-to-expenditure ratio (NIER). The capacity of a bank's management to generate profits from its assets is shown by its ROA. NIER shows how well the bank can cover its costs through financial and operating income. Parvin et al. (2020), Chiaramonte and Casu (2017), and Sahyouni and Wang (2019) all used these measurements in their studies.

3.3.2. Independent Variable

In this study, to gauge the explanatory variables (capital structure), three proxies were used, namely, equity/asset ratio (EAR), debt-to-loan (DTL), and deposit-to-asset ratio (DAR). The EAR represents the percentage of a company's overall equity allocated towards its operations. The DTL ratio quantifies a firm's borrowing about its loans. Increasing debt usage results in a higher debt-to-loan ratio (DTL ratio). Parvin et al. (2020) state that the DAR is a standard ratio that gauges a firm's deposits relative to its assets.

3.3.3. Mediating Variable

In this study, to measure the mediating variable (liquidity risk), two proxies were employed, namely, the loan-to-deposit ratio (LTD) and cash-to-deposit ratio (CTD). The LTD ratio is commonly employed to assess liquidity and credit risk. It is calculated by dividing a bank's total loans or financing by its total deposits. Adam (2014) states that a bank's loans are funded through deposits, regardless of the situation, as indicated by this ratio. The CTD measures the bank's lending capacity based on deposits and indicates its primary banking operations (Burksaitiene and Draugele 2018; Goel and Kumar 2016). Table 1 displays the variables and their respective measurements utilised in the study.

Table 1. Study variables.

Description and Variables	Symbol	Measurement of Variables	Source
Financial Performance	FP	$ROA = \text{Net Income} / \text{Total Asset}$ $NIER = (\text{Total Revenue} - \text{Total Expenses}) / \text{Total Expenses}$	Parvin et al. (2020)
Capital Structure	CS	$EAR = \text{Equity} / \text{Asset}$ $DTL = \text{Debt} / \text{Loan}$ $DAR = \text{Deposit} / \text{Asset}$	Parvin et al. (2020)
Liquidity risk	LR	$LTD = \text{Total Loans} / \text{Total Deposits}$ $CTD = \text{Total Cash} / \text{Total Deposit}$	Hacini et al. (2021); Burksaitiene and Draugele (2018)

Using an established conceptual framework, this study focuses on the mediating role of liquidity risk in the relationship between capital structure and financial performance. The theoretical framework allows an exploration of complex relationships without the need for control variables. While control variables can be helpful, they may complicate this initial investigation into these relationships. We aim to understand the dynamics between capital structure, liquidity risk, and financial performance. Adding control variables at this stage may obscure these core dynamics. However, future research could benefit from

including control variables for a more nuanced understanding, contributing to a more comprehensive view of these phenomena.

3.4. Econometric Equation

The econometric model, sometimes referred to as an algebraic model, is mentioned below.

$$FP_i = \alpha_i + \beta_1 CS_i + \varepsilon_i \quad (1)$$

$$LR_i = \alpha_i + \beta_1 CS_i + \varepsilon_i \quad (2)$$

$$FP_i = \alpha_i + \beta_1 LR_i + \varepsilon_i \quad (3)$$

$$FP_i = \alpha_i + \beta_1 CS_i + \beta_2 LR_i + \varepsilon_i \quad (4)$$

In the above model,

α is the intercept term;

β_1, β_2 are coefficients of variables;

FP represents financial performance;

CS represents capital structure;

LR represents liquidity risk.

4. Data Analysis

The study aims to investigate the influence of capital structure on the financial performance of Jordanian banks and explore the mediating role of liquidity risk. To achieve these objectives, we employ a multifaceted analytical approach that combines descriptive analysis, correlation analysis, panel data estimation methods, and structural equation modelling (SEM).

Our descriptive analysis provides a comprehensive overview of the data, including measures of central tendency and dispersion, helping to identify patterns and trends in the variables over the study period. This is complemented by correlation analysis, which assesses the strength and direction of associations between variables, offering preliminary insights into potential relationships.

Given the nature of our data (cross-sectional and time-series), we utilise advanced panel data techniques such as fixed effects or random effects models, depending on the results of specification tests (e.g., Hausman test). These methods allow us to control for unobserved heterogeneity across banks and over time, which is particularly valuable given our sample size. The panel data approach enhances the robustness of our findings by accounting for both individual bank characteristics and temporal changes.

To investigate the mediating role of liquidity risk in the relationship between capital structure and financial performance, we employ structural equation modelling (SEM). This sophisticated technique is beneficial for our sample size as it allows for the simultaneous estimation of multiple relationships and the incorporation of latent variables, providing a more holistic understanding of the complex interplay between our variables of interest.

We implement several strategies to address potential limitations associated with our sample size. We conduct rigorous data validation, including thorough checks for outliers, missing data, and potential reporting errors to ensure the quality of our dataset. Where appropriate, we use bootstrapping techniques to generate robust standard errors and confidence intervals, which can help mitigate concerns about the normality assumption in smaller samples.

The descriptive analysis findings of the study variables are shown in Table 2. Several vital measures were employed to explore financial performance, capital structure, and liquidity risk among the firms under study, each providing unique insights into the companies' operations and financial health. Analysing financial performance via the proxies of ROA

and NIER, we observed average values of 0.0094 and 0.4532, respectively. These values suggest that, on average, the firms are generating a return of 0.94% on their assets and that their net income comprises approximately 45.32% of total expenditures. The respective standard deviations of 0.0045 and 0.1757 underscore the variability within our dataset, hinting at the distinct financial performance strategies employed by the firms. Turning to capital structure, assessed through EAR, DTL, and DAR, we find mean values of 0.1286, −0.1483, and 0.7033, respectively. These values indicate that, on average, equity makes up about 12.86% of total assets, while debts are typically less than loans, and deposits are less than assets. The associated standard deviations for EAR (0.0295), DTL (0.2119), and DAR (0.0867) reflect significant variability within the data, implying substantial divergence in capital structure strategies across the firms. Lastly, the liquidity risk, evaluated through the LTD and the CTD, presented mean values of 0.7343 and 0.1739, respectively. This suggests that the firms' loans constitute about 73.43% of their total deposits, while cash on hand forms approximately 17.39% of deposits. With standard deviations of 0.1056 for LTD and 0.0571 for CTD, the data illustrates considerable variance among the firms, reflecting the diversity of liquidity risk profiles they have adopted. DTL scores have negative values because the variable DTL was transformed by multiplying it by −1.

Table 2. Descriptive analysis.

Variables	Mean	SD	Q1	Median	Q3	Min	Max	Z-Value	N
ROA	0.0094	0.0045	0.0059	0.0093	0.0128	−0.0016	0.0185	1.1450	78
NIER	0.4532	0.1757	0.3099	0.4391	0.5797	0.1273	0.8054	1.9814	78
EAR	0.1286	0.0295	0.1032	0.1227	0.1624	0.0750	0.1725	2.4071	78
DTL	−0.1483	0.2119	−0.2921	−0.1441	−0.0058	−0.7046	0.2067	0.8141	78
DAR	0.7033	0.0867	0.6474	0.6961	0.7575	0.5069	0.8660	0.6747	78
LTD	0.7343	0.1056	0.6854	0.7583	0.8033	0.4801	0.8912	0.0948	78
CTD	0.1739	0.0571	0.1298	0.1633	0.2143	0.0668	0.2967	1.5855	78

Note: ROA = return on assets, NIER = net income-to-expenditure ratio, EAR = equity/asset ratio, DTL = debt-to-loan, DAR = deposit-to-asset ratio, LTD = loan-to-deposit ratio, CTD = cash-to-deposit ratio. SD = standard deviation, Min = minimum, Max = maximum, N = sample size.

Table 3 shows the correlation among the study variables. Essentially, the results show no value higher than 0.9; otherwise, there will be a perfect correlation. In addition, the results of the conducted collinearity test show that all VIF values are less than 5, which means that the model does not suffer from a collinearity issue (Gujarati and Porter 2009). Capital structure measures are inversely related with the liquidity risk variables. Overall, these correlation findings emphasise the interconnectedness of various financial measures with firms' profitability, as gauged by ROA, and point towards the potential drivers of financial performance. However, a further SEM investigation could provide more depth and clarity to these relationships.

Table 3. Correlation analysis.

	ROA	NIER	EAR	DTL	DAR	LTD	CTD	VIF
ROA	1							–
NIER	0.7034 ***	1						2.13
EAR	0.3555 ***	0.3720 ***	1					1.78
DTL	−0.2687 **	−0.2303 **	−0.1978 *	1				3.42
DAR	−0.0382	−0.1054	−0.3630 ***	−0.6720 ***	1			2.95
LTD	0.1178	0.2253 **	0.3942 ***	0.5389 ***	−0.6436 ***	1		2.67
CTD	0.1906 *	0.3249 *	0.2593 **	−0.6800 ***	0.267 **	−0.2409 **	1	1

Note: ***. Correlation is significant at the 0.01 level (2-tailed), **. Correlation is significant at the 0.05 level (2-tailed), *. Correlation is significant at the 0.10 level (2-tailed). ROA = return on assets, NIER = net income-to-expenditure ratio, EAR = equity/asset ratio DTL = debt-to-loan, DAR = deposit-to-asset ratio, LTD = loan-to-deposit ratio, CTD = cash-to-deposit ratio. VIF = variance inflation factor.

Path Analysis

Using structural equation modelling (SEM), we test if liquidity risk mediates the relationship between financial performance and capital structure. To provide a more granular analysis, we test each capital structure measure individually in separate models. This approach allows us to examine the specific impact of each capital structure component on firm performance and its interaction with liquidity risk.

We use both return on assets (ROA) and net income-to-expenditure ratio (NIER) as indicators of firm performance to capture both profitability and efficiency aspects. ROA provides insight into overall profitability, while NIER focuses specifically on the efficiency of managing interest expenses relative to income. This dual approach allows for a more comprehensive assessment of bank performance. However, to ensure robustness, we will also conduct separate analyses using each performance measure individually.

Our analysis occurs in two stages: initially, excluding the mediator variable to display the capital structure's direct effect on firm performance. The second stage involves incorporating the mediator variable, liquidity risk, into the existing model. In both stages, we report standardised results for all path coefficients and effect sizes. Standardisation allows for easier comparison of effects across different variables and facilitates interpretation of the relative importance of each path in the model.

Our structural equation model is evaluated using multiple fit indices to ensure robust assessment of model fit. In addition to the Chi-square test, we report the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR) in Appendix A Table A1. This comprehensive approach to model evaluation aligns with current recommendations in the SEM literature.

Furthermore, we conduct sensitivity analyses to assess the stability of our results. This includes testing alternative model specifications and using bootstrapping techniques to generate confidence intervals for indirect effects in our mediation analysis.

The first mediation condition is met if the coefficient value decreases compared to step one and average variance extracted (AVE) increases when liquidity risk is included. The persistence of significant evidence post-inclusion of the mediator hints at partial mediation, while its disappearance indicates full mediation. Our model comprises latent variables depicting the proposed and endogenous variables, demonstrating the dimensions' sentences.

The results presented in Table 4 provide insights into the complex relationships between capital structure, firm financial performance, and liquidity risk in Jordanian banks. These findings warrant a careful interpretation considering both direct and indirect effects.

Table 4. Summary of the results.

Estimation Results		Estimate	S.E.	C.R.	p-Value	Adjusted R-Square
Direct effect	Capital structure ----> Firm performance	0.019	0.009	2.013	0.044	0.487
	Capital structure ----> Firm performance	−0.014	0.27	−0.535	0.592	0.489
Indirect effect	Capital structure ----> Liquidity Risk	−1.122	0.21	−5.334	0.000	
	Liquidity Risk -----> Financial Performance	−0.027	0.022	−1.255	0.209	

Direct Effect: The direct association (see Figure 2) between capital structure and firm financial performance is positive (0.019) and statistically significant at the 5% level ($p = 0.044$). This suggests that, on average, banks with higher levels of debt in their capital structure tend to exhibit better financial performance. The adjusted R-square for this direct effect model is 0.487, indicating that capital structure explains 48.7% of the variance in firm financial performance. This moderate explanatory power suggests that while capital structure is an important predictor of firm performance, other factors not included in this model also play substantial roles.

This positive relationship aligns with findings from several recent studies in the banking sector. For instance, Pham et al. (2022) found a positive impact of capital structure on the financial performance of Vietnamese commercial banks, while Javed et al. (2014) reported similar results in their study of Pakistani firms.

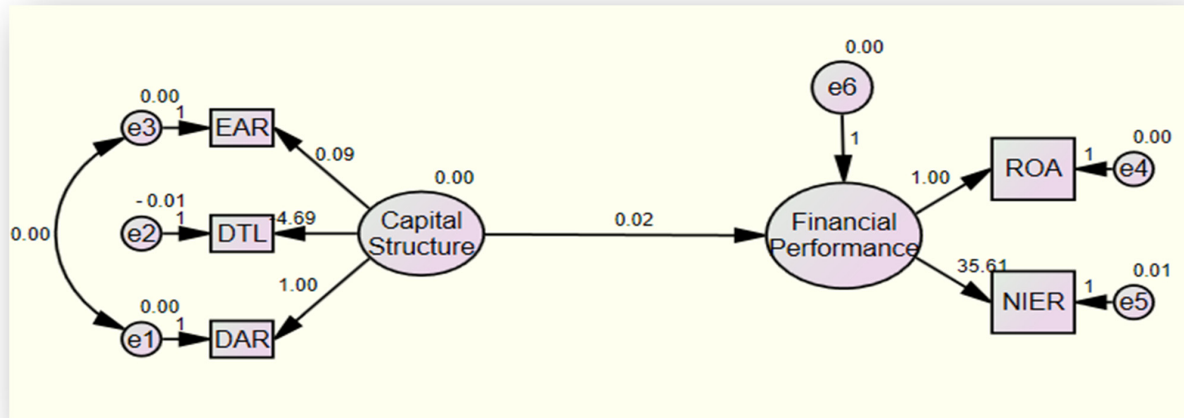


Figure 2. The direct effect of capital structure on firm performance.

Indirect Effect and Mediating Role of Liquidity Risk: The analysis of the indirect effect (See Figure 3) reveals a more complex picture. The indirect effect of capital structure on firm performance through liquidity risk is negative (-0.014) but not statistically significant ($p = 0.592$). This result requires a nuanced interpretation of the mediating role of liquidity risk.

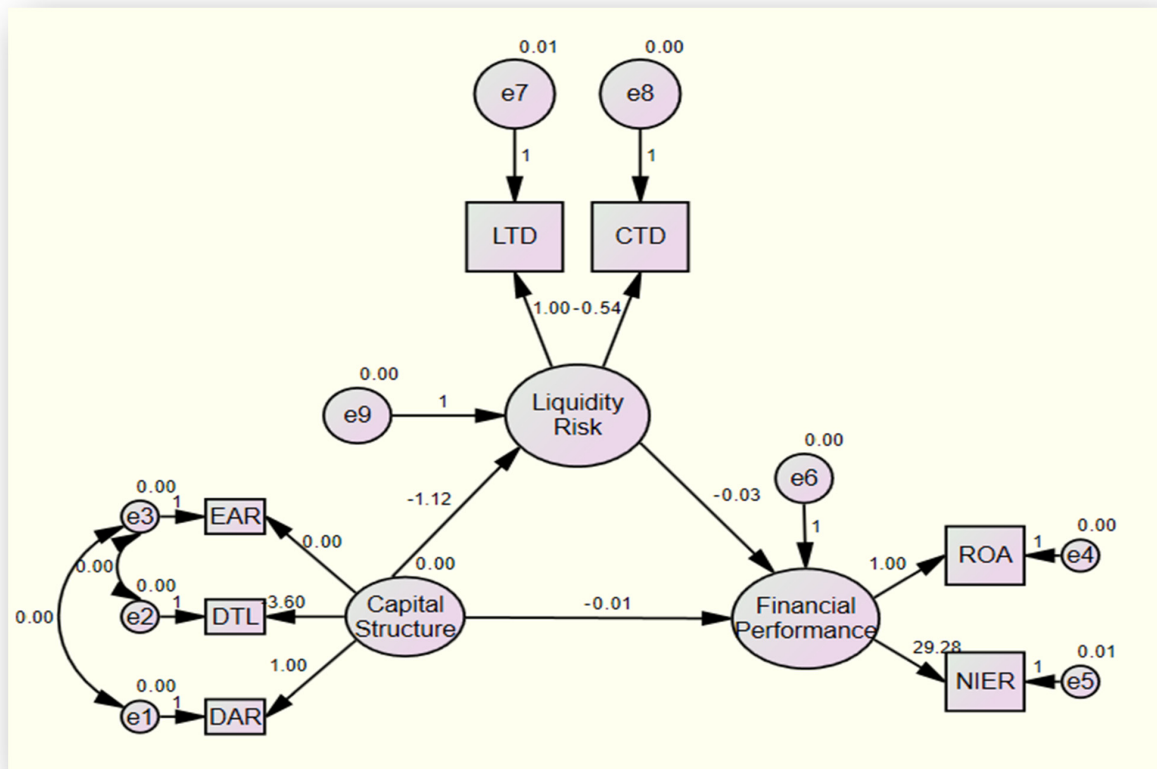


Figure 3. The indirect effect of capital structure on firm performance in the presence of liquidity risk.

According to contemporary mediation analysis principles (Hayes 2018), a significant indirect effect is not always necessary to establish mediation. Instead, we should consider the following components of our model:

1. The significant direct effect of capital structure on firm performance ($0.019, p = 0.044$);
2. The significant effect of capital structure on liquidity risk ($-1.122, p < 0.001$);
3. The non-significant effect of liquidity risk on financial performance ($-0.027, p = 0.209$).

These results suggest a pattern of inconsistent mediation (MacKinnon et al. 2007). While capital structure significantly influences both firm performance and liquidity risk, the pathway from liquidity risk to firm performance is not statistically significant. This could indicate the following: (a) liquidity risk may be influencing firm performance through mechanisms not captured in our current model; (b) the relationship between liquidity risk and firm performance may be non-linear or contingent on other factors; and (c) the effect of liquidity risk on firm performance might be too small to detect with our current sample size, suggesting the need for further research with larger datasets.

The adjusted R-square for the model including the indirect effect is 0.489, only marginally higher than that of the direct effect model. This small increase suggests that while liquidity risk does play a role in the relationship between capital structure and firm performance, its contribution to explaining overall variance is limited.

Importantly, our results show that capital structure negatively affects liquidity risk (-1.122) and is significant at the 1% level. This suggests that banks with higher levels of debt in their capital structure tend to have lower liquidity risk. This finding is consistent with the “risk absorption” hypothesis proposed by (Bhattacharya and Thakor 1993), which suggests that banks with higher capital ratios are better able to absorb liquidity shocks.

However, the non-significant relationship between liquidity risk and financial performance ($-0.027, p = 0.209$) is somewhat surprising. This result diverges from some previous studies (Ramzan and Zafar 2014) that found significant relationships between liquidity risk and bank performance. This discrepancy might be due to the specific context of Jordanian banks or could indicate that the relationship is more complex than our linear model assumes.

These findings align with recent literature suggesting complex, context-dependent relationships between capital structure, liquidity risk, and firm performance in the banking sector (Pham et al. 2022). Our results highlight the need for more sophisticated models that can capture the nuanced interplay between these factors.

In conclusion, while our initial hypothesis of full mediation is not supported, the results reveal a complex relationship between capital structure, liquidity risk, and firm performance in Jordanian banks. The significant direct effect of capital structure on firm performance, coupled with its significant impact on liquidity risk, suggests that capital structure decisions play a crucial role in bank management. However, the non-significant relationship between liquidity risk and firm performance indicates that this aspect of bank operations may require further investigation.

For a comprehensive overview of the study objectives and hypothesis results, please refer to Table 5, which summarizes the key findings of this research.

Table 5. Remarks table.

S.no	Research Objectives	Hypothesis	Remarks
1	To scrutinise the influence of banks' capital structures on Jordanian banking performance	H1. Banks' capital structures in the Jordanian banking sector significantly impact their financial performance.	H1: Accepted
2	To check the role of capital structure of banks on liquidity Risk	H2. Capital structure of banks in the Jordanian banking sector significantly impacts liquidity risk.	H2: Accepted
3	To examine the role of liquidity risk in Jordanian banking financial performance	H3. Banks' liquidity risk in the Jordanian banking sector significantly impacts their financial performance.	H3: Not Accepted
4	To scrutinise the mediating role of liquidity risk between the relationship of capital structure and financial performance in the Jordanian banking sector	H4. Liquidity risk mediates the relationship between capital structure and financial performance in the Jordanian banking sector.	H4: Partially Accepted

5. Discussion

The study's findings highlight the intricate relationships between capital structure, liquidity risk, and financial performance within the banking sector. These results provide valuable insights and align with various recent studies, contributing to the ongoing discourse in financial research.

Firstly, the positive and significant direct effect of capital structure on financial performance aligns with recent findings by Pham et al. (2022), who reported similar positive impacts in Vietnamese banks. This suggests that capital structure enhances a bank's financial performance. However, this study's findings diverge from those of Mumtaz et al. (2013), and Onalapo and Kajola (2010), who reported either a negative or non-significant relationship between capital structure and financial performance. These discrepancies underscore the complexity of this relationship and suggest that contextual factors, such as regulatory environments and market conditions, may play a crucial role.

The study assesses the relationship between capital structure and liquidity risk, revealing a significant negative association. This finding aligns with the work of Lipson and Mortal (2009) and Šarlija and Harc (2012), who found that higher levels of debt in the capital structure are associated with lower liquidity risk. This negative relationship can be explained through the "risk absorption" hypothesis proposed by Bhattacharya and Thakor (1993), suggesting that banks with higher capital ratios are better equipped to absorb liquidity shocks. Additionally, Acosta Smith et al. (2019) argue that banks with larger capital bases can more effectively manage liquidity risk by maintaining sufficient liquid assets, even though these assets may yield lower returns compared to illiquid ones.

Regarding liquidity risk's impact on financial performance, this study finds an inverse relationship, consistent with the findings of Arif and Nauman Anees (2012) and Chen et al. (2018). These studies suggest that elevated liquidity holdings can dampen financial performance due to the higher costs associated with maintaining liquidity. Bordeleau and Graham (2010) further posit that the relationship between liquidity and financial performance is not linear but rather complex and context-dependent. This complexity is echoed by Ehiedu (2014), who emphasises the trade-off between profitability and liquidity, suggesting that excessive liquidity can erode profitability, while insufficient liquidity can lead to financial instability.

Regarding the mediating role of liquidity risk between capital structure and financial performance of Jordanian banks, the study's findings reveals that liquidity risk mediates the relationship between capital structure and financial performance. This finding aligns with the theoretical perspectives of Diamond and Rajan (2000), who suggest that banks must balance their capital structures to effectively manage liquidity risk. The significant mediating role of liquidity risk is also supported by the work of Adeyanju (2011), who highlight the critical influence of liquidity on bank profitability and stability. These findings

are partially supported by the outcomes of Ruziqa (2013), who concluded that liquidity risk and credit jointly influence bank financial performance.

Contributions

This research contributes and enriches the existing literature on risk and capital structure in two ways. First, these findings contribute to the existing literature by providing empirical evidence from Jordanian banks and highlighting the complex interplay between capital structure, liquidity risk, and financial performance. The study underscores the importance of capital structure and effective liquidity risk management in enhancing bank performance and stability. In particular, we tested the mediating role of liquidity risk between capital structure and financial performance of banking industries. Although there are previous studies of similar relationships, the concentrated model is not tested in the Jordan banking industry. Hence, we enrich the literature on how liquidity risk mediates the path between capital structure and financial performance of banks. Second, our research contributes to the theory of capital structure through empirical evidence. For instance, the theory determines the values and percentage of the overall cost of capital in a company's outcomes and financial performance. Our research extended the scope of the theory by employing liquidity risk as a mediating factor and confirmed that the relationship is significantly affected.

6. Conclusions

This study, utilising robust structural equation modelling (SEM) applied to a comprehensive dataset encompassing Jordanian banks from 2015 to 2022, unveils a nuanced understanding of the interconnectedness between capital structure, liquidity risk, and a bank's financial performance. Our findings demonstrate a statistically significant positive influence of capital structure, measured by the equity/asset ratio, debt-to-loan ratio, and deposit-to-asset ratio, on financial performance metrics like return on assets (ROA) and net income-to-expenditure ratio (NIER). This empirical evidence reinforces the established theoretical construct that capital structure is a cornerstone of achieving superior financial outcomes for banks operating in the Jordanian market.

However, the study reveals a crucial mediator in this relationship. A particularly noteworthy contribution lies in the complete mediation of liquidity risk within the association between capital structure and financial performance. This unveils a previously unexplored mechanism through which capital structure choices indirectly influence financial health. Our analysis suggests that capital structure decisions significantly impact a bank's liquidity risk profile. A well-capitalised bank, with a higher equity/asset ratio and a lower debt-to-loan ratio, can maintain a more robust buffer against unexpected withdrawals or market fluctuations. This translates into lower liquidity risk. Conversely, banks with a higher reliance on debt financing are more susceptible to liquidity disruptions, increasing their risk. Subsequently, this altered liquidity risk profile has a demonstrably inverse effect on financial performance. Lower liquidity risk, facilitated by the capital structure, allows banks to operate more efficiently, minimise funding costs reflected in the net income-to-expenditure ratio, and potentially generate higher returns, as evidenced by the positive association with ROA.

This cascading effect underscores the crucial role of liquidity management as the bridge between capital structure decisions and tangible financial results. It highlights the intricate dance Jordanian banks must undertake, balancing the need for adequate liquidity to fulfil obligations with the simultaneous pursuit of profit generation through asset deployment. Effective liquidity risk management strategies become paramount in translating capital structure into sustained financial well-being.

In conclusion, this study offers a significant contribution to the existing body of knowledge on banking in emerging markets. By unveiling the intricate interplay between capital structure, liquidity risk, and financial performance, it provides a comprehensive framework for understanding how capital structure decisions ripple through a bank's

operations, impacting its financial health. These findings are particularly valuable for the Jordanian banking sector, informing strategic decisions and shaping regulatory policies. However, the broader theoretical implications extend to similar emerging market contexts, offering valuable insights for navigating the complexities of capital structure management and liquidity risk mitigation in the pursuit of sustainable financial performance.

6.1. Practical Implications

The results of this study hold significant implications for both banking practice and regulatory policy within Jordan. Understanding the intricate interplay between these factors allows for a more informed approach to financial management in Jordanian banks.

For Banking Practice: The issues are capital structure optimisation with a liquidity focus. This study underscores the critical need for Jordanian banks to optimise their capital structure while maintaining a keen focus on mitigating liquidity risk. A capital structure that combines appropriate levels of debt and equity not only directly enhances financial performance, but also facilitates a more robust liquidity profile. This allows banks to operate with greater efficiency and potentially generate higher returns. Implementing robust liquidity risk management strategies becomes paramount in achieving these goals.

For Regulatory Policy: Capital Adequacy and Liquidity Risk Integration: Regulatory bodies in Jordan should consider integrating the intricate interplay between capital structure, liquidity risk, and financial performance when formulating policies. This might involve developing capital adequacy requirements that account for a bank's liquidity risk profile. Banks with a more equity-weighted capital structure, as evidenced by factors like a higher equity /asset ratio and lower debt-to-loan ratio, could potentially be granted some flexibility in capital adequacy requirements, provided they maintain a strong liquidity risk management framework. This approach would incentivise capital structure while ensuring financial stability through effective liquidity management.

6.2. Limitations

While this study offers valuable insights, it is essential to acknowledge its limitations to guide future research endeavours.

Generalisability to Broader Emerging Markets: While the study provides valuable insights for Jordanian banks, the generalisability of these findings to other emerging markets may be limited. Future research can explore whether the observed relationships between capital structure, liquidity risk, and financial performance hold true in other emerging economies with different banking system characteristics and regulatory environments.

Longitudinal Analysis for Causal Strength: The study employs cross-sectional data, which limits the ability to establish definitive causal relationships. Future research employing longitudinal data analysis over an extended period can provide stronger evidence for causal links between capital structure decisions, changes in liquidity risk, and their subsequent impact on financial performance in Jordanian banks.

Metrics for Liquidity Risk Nuances: While the study explores liquidity risk, future research can delve deeper by incorporating additional metrics that capture specific aspects of liquidity risk faced by Jordanian banks. This could involve including measures like the loan-to-deposit ratio or liquidity coverage ratio, providing a more nuanced understanding of how capital structure choices influence different facets of liquidity risk and ultimately impact financial performance.

6.3. Future Research Directions

Building upon this study's foundation, future research should prioritise two key areas to refine our understanding and offer more actionable insights for Jordanian banks and regulators:

1. Refining Liquidity Risk Measurement:

Incorporate additional liquidity risk metrics specific to the Jordanian banking context. This could include the loan-to-deposit ratio (LDR) and liquidity coverage ratio (LCR).

Analysing how capital structure choices influence these metrics would provide Jordanian banks with a more granular understanding of their liquidity risk profile.

2. Macroeconomic Factors and Regulatory Changes:

Impact Assessment: Investigate how macroeconomic factors (e.g., recessions) and regulatory changes (e.g., capital adequacy requirements) influence the relationship between capital structure, liquidity risk, and financial performance. This would offer Jordanian regulators a more holistic view of the dynamics at play, allowing them to formulate policies that incentivise capital structure for Jordanian banks and ensure financial stability through effective liquidity management practices.

By focusing future research on these two areas, we can create a more comprehensive understanding of how capital structure decisions translate into financial performance through the lens of liquidity risk in the Jordanian banking context. This knowledge will be valuable for both banks and regulators in promoting a robust and financially healthy banking sector in Jordan.

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Appendix A

Table A1. The goodness of fit statistics.

Model Fit Criteria	Actual	Threshold	Remakes
CMIN	11.021	-	
DF	4	-	
CMIN/DF	2.75	Less than 3	Acceptable
CFI	0.851	Greater than 0.80	Acceptable
TLI	0.862	Greater than 0.80	Acceptable
RMSEA	0.039	Less than 0.06	Acceptable
SRMR	0.023	Less than 0.0	Acceptable

Table A2. Regression analysis.

Variables	Model-1 Financial Performance		Model-2 Liquidity Risk		Model-3 Financial Performance		Model-4 Financial Performance	
	β	<i>p</i> -Value	β	<i>p</i> -Value	β	<i>p</i> -Value	β	<i>p</i> -Value
Capital structure	0.0160	0.000	−0.0399	0.000			−1.208	0.000
Liquidity Risk					−0.630	0.023	−1.446	0.000
R-square	0.244		0.707		0.067		0.321	
F-statistics	0.001		0.001		0.023		0.001	

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Article

Does Corporate Governance and Earning Quality Mitigate Idiosyncratic Risk? Evidence from an Emerging Economy

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Abstract: This study investigates evolving corporate governance mechanisms within the context of an emerging economy. Addressing a literature gap, this study analyses the influence of corporate governance and earnings quality on idiosyncratic risk in an emerging economy. In particular, this research explores the impact of corporate governance practices and earnings quality on idiosyncratic risk. For this purpose, this research utilises a sample of 75 non-financial firms listed on the Pakistani equity market over nine years from 2010 to 2018. Employing the generalised method of moments, the findings of our empirical analysis reveal that firms with robust governance mechanisms and higher earnings quality experience minimal idiosyncratic risk. These outcomes provide valuable insights for standard setters, regulatory authorities, policymakers, and other stakeholders, emphasising the importance of governance mechanisms and earnings management in mitigating idiosyncratic return volatility.

Keywords: idiosyncratic risk; accrual quality; earnings quality; corporate governance; board quality index

1. Introduction

Stock return volatility in corporations is influenced by two primary types of risk: idiosyncratic and market risks, both of which are integral to investment decisions (Irvine and Pontiff 2009). Idiosyncratic return volatility, related to specific attributes of a corporation, can be mitigated through diversification (Fonou-Dombeu et al. 2022). While investors typically prioritise undiversifiable risk in their investment decisions, the market's competitive nature also compels them to consider idiosyncratic risk (Domingues 2016). Further, the quality of accounting and the effectiveness of corporate governance are critical indicators of investors' perceptions of a firm's reputation, integrity, and trustworthiness (Silva 2019). However, there is a lack of studies examining the role of corporate governance mechanisms and earnings quality in risk management within emerging markets, such as Pakistan. Previous research in developed countries (Asker et al. 2015; Chang et al. 2015; Li et al. 2013; Nguyen 2011; Wamba et al. 2018) has established that robust corporate governance practices reduce idiosyncratic return volatility (also see Gholami et al. 2023).

Similarly, the existing literature (Morck et al. 2000; Aman 2011; Chan and Hameed 2006) has shown that poor earnings quality increases idiosyncratic volatility. Despite these findings, the literature on the relationship between corporate governance, earnings quality, and idiosyncratic risk in developing markets remains underdeveloped. This research aims to fill this literature gap in the empirical literature. In particular, this study aims to provide empirical evidence on how effective corporate governance and poor earnings quality

influence firm-specific risk in an emerging market like Pakistan. Firms in emerging markets exhibit unique governance attributes and ownership structures, making idiosyncratic risk particularly significant. Emerging stock markets attract global investors due to their dynamic nature. For instance, the Pakistan equity market has outperformed regional markets, becoming the best-performing market in Asia. However, weak governance and poor investor protection for minority shareholders in these markets increase firm-specific risk, making investors more cautious about investing in such stocks (Pathaka and Ranajee 2020; Chauhan et al. 2018; Gul et al. 2010). Further, along these lines, insider trading is prevalent in emerging markets (Fareed et al. 2022), where insiders exploit private information for personal gain, further increasing idiosyncratic risk (Zhou et al. 2017). Regulatory authorities in emerging markets, such as the China Securities Regulatory Commission (CSRC) and the Securities and Exchange Commission of Pakistan (SECP), impose various restrictions, including price limits and short-selling regulations, which can impact firm-specific volatility (Luo et al. 2015).

This research addresses how corporate governance attributes and earnings quality impact idiosyncratic risk in Pakistani listed enterprises. In this context, this study analyses the impact of corporate governance attributes and earnings quality on idiosyncratic risk in Pakistani listed enterprises, using data from 75 non-financial firms from 2010 to 2018. Our contribution to the literature is twofold. First, this study examines the impact of corporate governance attributes by constructing a Board Quality Index (BQI) encompassing a comprehensive set of governance features. Then, this research investigates how individual characteristics and the BQI influence idiosyncratic risk, focusing on five internal corporate governance mechanisms: (1) board independence, (2) board size, (3) institutional ownership, (4) gender diversity, and (5) board characteristics. The novelty of our research lies in its dual contribution: (1) developing a comprehensive Board Quality Index, and (2) examining the specific context of corporate governance and earnings quality in an emerging market. Previous studies (Mathew et al. 2018; Pathaka and Ranajee 2020) suggest that robust earnings-quality reporting provides consistent information to stakeholders about a firm's prospects, fostering trust in the reported earnings. Therefore, this study also examines the relationship between earnings quality and firm-specific return volatility.

This paper employs a panel unit root test to determine the stationarity properties of the variables, following Chang et al. (2011), who noted the importance of stationarity testing in dynamic panel data models (also see Ali et al. 2023; Rahman et al. 2023). Given that all variables are significant at the first difference, this study uses the Generalized Method of Moments (GMM) framework proposed by Arellano and Bond (1991) to test our hypotheses. Our findings reveal a significant correlation between earnings quality and idiosyncratic return volatility, indicating that poor earnings quality increases firm-specific return volatility. Furthermore, corporate governance mechanisms generally show a negative relationship with idiosyncratic risk, suggesting that Pakistani firms' unique governance features and ownership characteristics help reduce firm-specific risk.

The structure of this study is as follows: Section 2 covers the literature review, Section 3 details the research methodology, Section 4 presents the findings, analysis, and discussion, followed by Section 5, which provides the conclusion and implications.

2. Theoretical Background and Hypothesis Development

In 1952, Markowitz introduced the portfolio theory, which suggests that investors can minimise risk by diversifying their portfolios. Building on this, Lintner (1965) and Sharpe (1964) developed the Capital Asset Pricing Model (CAPM), using Markowitz's theory as its foundation. According to CAPM, investment risk is categorised into systematic and unsystematic. Systematic risk, associated with market factors, cannot be diversified. In contrast, unsystematic risk, specific to individual stocks, can be mitigated through diversification, exemplifying idiosyncratic risk (Nguyen et al. 2021). Jensen and Meckling (2019) proposed the agency theory, which explains the relationship between agents (executives) and principals (owners). This theory explains the connection between stock return volatility

and ownership (Vo 2016). According to agency theory, information asymmetry can lead to adverse selection and moral hazard issues, resulting in poor financial reporting quality and encouraging dysfunctional executive behaviour. It might be relevant to note that the information asymmetry among stakeholders results in over- or under-investment, which directly impacts the firm's earnings quality (see Jensen and Meckling 2019).

2.1. Earnings Quality (EQ) and Idiosyncratic Return Volatility (IDR)

Earnings quality has been popular in the finance literature over the last two decades, and several studies have attempted to explore the association between earnings quality and idiosyncratic volatility. Along these lines, one strand of literature (Campbell et al. 2001; Fonou-Dombeu et al. 2022; Persakis and Iatridis 2015) attempted to explore the theoretical linkages of the association between the earnings quality and idiosyncratic volatility (also see Arian 2024). Healy et al. (1999), along with Diamond and Verrecchia (1991), argued that enhancing the quality of financial reporting and disclosures reduces information asymmetries, thereby mitigating stock price volatility. Similarly, Leuz and Verrecchia (2000) assert that information asymmetry is directly related to stock return volatility. Scholars such as Easley and O'hara (2004) have demonstrated that a corporation's disclosure policy, earnings accounting treatment, and financial reporting quality significantly impact its information environment, influencing the idiosyncratic volatility of the firm. Another stream of research utilised proxies like Dechow and Dichev's (2002) accrual quality and Jones' (1991) absolute abnormal accruals to measure earnings quality, yielding mixed findings. For instance, Aboody et al. (2005) and Francis et al. (2005) analysed EQ as a measure of information risk, emphasising that EQ affects the expected return. On a similar note, Nguyen et al. (2024) provided strong evidence from the hand-collected data of 800 Vietnamese non-financial firms that corporate governance quality restrains earnings management.

Further studies by Hutton et al. (2009), Jin and Myers (2006), Piotroski and Roulstone (2004), Durnev et al. (2003), Ferreira and Laux (2007), Rajgopal and Venkatachalam (2011), and Mitra (2016) documented a significant positive correlation between firm-specific return volatility (FSRV) and EQ, concluding that poor EQ is associated with low idiosyncratic volatility. Conversely, researchers such as Li et al. (2014), Bartram et al. (2012), and Zhou et al. (2017) found an inverse correlation between EQ and IDR, suggesting that higher earnings quality mitigates FSRV. Moreover, scholars argue that stock price behaviour varies between emerging and developed markets. They conclude that poor earnings quality in emerging markets enhances idiosyncratic volatility (Morck et al. 2000; Aman 2011; Chan and Hameed 2006). On these theoretical grounds, this study proposes the following empirical conjecture.

H1. *Earnings Quality (EQ) positively influences the idiosyncratic return volatility.*

2.2. Corporate Governance (Hereafter, CG) and Idiosyncratic Return Volatility (IDR)

The existing literature presents mixed empirical findings regarding investment in local equity markets (Bekaert and Harvey 1997; Vo 2016; Bai et al. 2004; Fareed et al. 2022). Cronqvist and Fahlenbrach (2008) and Umutlu et al. (2010) state that a higher investment tendency in emerging markets enhances the quality of information CG practices, thereby reducing information and transaction costs. Drawing on agency theory and CAPM, studies have found that good CG mechanisms help enterprises mitigate idiosyncratic risk (Ferreira and Laux 2007; Chang et al. 2015; Asghar et al. 2020; Muhammad et al. 2022).

Most previous studies have documented that return volatility is linked to macroeconomic factors such as spillover effects, political affairs, and economic recessions. However, recent studies suggest that CG practices also influence idiosyncratic return volatility (Asker et al. 2015; Rogers and Securato 2009). Brennan and Xia (2001) and Alti (2003) state that excess volatility arises from incomplete information, reducing monitoring effectiveness. Research has shown that CG practices, such as board composition and ownership structure,

significantly determine a corporation's value (Wang 2016). Effective CG can prevent minority shareholder wealth expropriation, particularly in emerging markets lacking robust CG mechanisms (Gompers et al. 2003; Chen et al. 2012; Gul et al. 2010; Abu-Ghunmi et al. 2015). Better CG practices are associated with lower exposure to idiosyncratic return volatility (Ghafoor et al. 2019).

Key CG characteristics include board composition, board independence (BDI), board size (BSZ), ownership structure (ISO), and gender diversity (GDD). The literature suggests that board independence is crucial for good CG (Black and Kim 2012; Bebczuk and Weisbach 2010). Board independence creates both opportunities and risks for a business (Peng 2004). Minimal levels of BDI are linked with minimal levels of risk, whereas higher levels of information asymmetry pose challenges for independent directors overseeing risky firms (Brick and Chidambaran 2008). A higher ratio of independent directors effectively monitors firms' operations (Tricker 2010). Furthermore, board size influences decision-making mechanisms and affects the board's effectiveness, although larger board sizes are linked with higher total risk (Ho et al. 2013). Gender diversity plays a significant role in effective decision-making and improving board effectiveness (Benkraiem et al. 2017; Loukil et al. 2019; Guizani and Abdalkrim 2023).

A parallel strand of research documents mixed findings concerning board composition's impact on idiosyncratic return volatility (Chong et al. 2018; Zhang et al. 2018; Chakraborty et al. 2019). Chichernea et al. (2015) assert that institutional ownership's influence on idiosyncratic volatility varies by type, and Vo (2016) states that institutional ownership improves CG. Scholars present mixed results regarding the link between ISO and IDR (Xu and Malkiel 2003; Zhang 2010). Board attributes such as gender diversity, CEO duality, board size, ownership structure, and independent directors are negatively linked with idiosyncratic risk (Wu et al. 2020; Fareed et al. 2022; Haider and Fang 2016, 2018; Ali et al. 2024). Based on the above discussion, this study proposes the following hypotheses:

H2. *Board independence has an inverse relationship with idiosyncratic return volatility.*

H3. *Board size has an inverse relationship with idiosyncratic return volatility.*

H4. *Gender diversity has an inverse impact on idiosyncratic return volatility.*

H5. *Institutional ownership negatively affects idiosyncratic return volatility.*

3. Research Design

3.1. Sample Selection

The initial sample consisted of non-financial firms listed on the Pakistan equity market from 2009 to 2018. The idiosyncratic risk was calculated based on the returns of individual firms' stocks over the current and previous years, covering 24 months. Therefore, data for other variables span 2009–2018, while the research period itself is 2010–2018. Firms in service industries, insurance companies, and financial institutions were excluded since the empirical models for earnings quality used in this study do not adequately reflect their activities.

Initially, data were collected from 2003 onwards to estimate the parameters for Dechow and Dichev's (2002) model, since these parameters require lag and lead values of cash flows from operations and five annual residuals for earnings quality indicators. After restricting our sample to firms with complete data for all response, explanatory, and control variables and excluding firm years with missing information on any of these indicators, the final sample comprised 75 non-financial firms. This research excluded financial firms due to their (1) unique regulatory environment and (2) accounting practices. Including financial firms could introduce variability that might affect our empirical results. All empirical

analyses in this study are based on this final sample. The sample selection criteria are detailed in Table 1.

Table 1. Sample selection.

Selection Criteria	Observations
Observations during the period 2009–2018	122
Subtract: Observations with missing data on earnings quality	−38
Subtract: Observations with missing data of other variables	−9
Final Sample	75

Note: The procedure followed for the sample selection is summarised in this panel.

3.2. Empirical Design

This study examined the effect of corporate governance and earnings quality on idiosyncratic risk. To verify hypotheses, this research estimates the following regressions:

$$IDR_{it} = \beta_0 + \beta_1 IDR_{t-1} + \beta_2 ABS_{it} + \beta_3 BDI_{it} + \beta_4 BSZ_{it} + \beta_5 ISO_{it} + \beta_6 GDD_{it} + \sum_n \beta_n X_{it}^n + \mu_{it} \quad (1)$$

$$IDR_{it} = \beta_0 + \beta_1 IDR_{t-1} + \beta_2 ACF_{it} + \beta_3 BDI_{it} + \beta_4 BSZ_{it} + \beta_5 ISO_{it} + \beta_6 GDD_{it} + \sum_n \beta_n X_{it}^n + \mu_{it} \quad (2)$$

$$IDR_{it} = \beta_0 + \beta_1 IDR_{t-1} + \beta_2 ABS_{it} + \beta_3 BDI_{it} + \sum_n \beta_n X_{it}^n + \mu_{it} \quad (3)$$

$$IDR_{it} = \beta_0 + \beta_1 IDR_{t-1} + \beta_2 ACF_{it} + \beta_3 BDI_{it} + \sum_n \beta_n X_{it}^n + \mu_{it} \quad (4)$$

In the abovementioned models, the dependent variable is an idiosyncratic risk, which IDR denotes. Following Xu and Malkiel (2003), the measurement of idiosyncratic return volatility is as follows:

$$\gamma^*_{i,j,t} = \varphi_1 + \beta_i \gamma_{j,t} + \mu_{i,j,t} \quad (5)$$

where, γ^* , γ , β_i , and $\mu_{i,j,t}$ represent the company's return, the industry return, the firm i exposure to its industry return, and the natural interpretation of idiosyncratic risk. This study defines idiosyncratic risk as $\text{VAR}(\mu_{i,j,t})$ and industry return volatility as $\sqrt{\text{VAR}(\mu_{i,j,t})}$ for each period. The key independent variables are corporate governance and earnings quality. Corporate governance is measured using four indicators: board size (BSZ), board independence (BDI), institutional ownership (ISO), and gender diversity (GDD). For robustness, this study constructs a board quality index using Principal Component Analysis (PCA) based on these four indicators. Earnings management, the second exogenous variable, is measured using two approaches. Following Mitra (2016), this study employs two measures of earnings quality: accrual quality (balance sheet approach) and absolute abnormal accruals (cash-flow approach).

This paper also includes firm-level characteristics as control variables, such as age, size, book-to-market ratio, and leverage (see Arian and Sands 2024a, 2024b). It is relevant to note that firm age and size help account for operational stability and resource availability. This study uses the book-to-market ratio to reflect the firm's market valuation relative to its book value. Leverage is included to control for financial risk due to debt obligations. In our empirical investigation, these control variables help isolate the specific effects of corporate governance and earnings quality on idiosyncratic risk. The existing literature has identified R&D intensity as a determinant of stock return volatility (Chan et al. 2001). It is suggested R&D intensity should be included as a control variable in the empirical model, subject to data availability. For further details on the explanation and measurement of variables, please refer to Appendix A.

4. Empirical Analysis

4.1. Descriptive Statistics

Table 2 presents the summary statistics for the 75 firms listed on the Pakistan Stock Exchange over nine years (2010–2018). The statistics include all variables' mean, standard

deviation, maximum, minimum, and observations. The summary statistics are divided into three groups: the whole sample observation, between the firm's observation, and within the observation period. According to Alodat et al. (2022), these statistical findings provide detailed descriptive information, enabling a comprehensive understanding and explanation of the data. The findings indicate that, on average, the idiosyncratic return volatility is 0.0169%. Earnings quality is measured using the cash-flow approach (Dechow and Dichev 2002) and the balance sheet approach (Jones 1991). The mean value for the balance sheet approach is -0.4811 , while for the cash-flow approach, it is -0.1003 . These values align with Latif et al. (2017) study. The study suggests that, on average, abnormal accruals should approximate zero, as negative and positive accruals offset each other over time.

Table 2. Descriptive statistics.

Variable		Mean	Std. Dev.	Min	Max	Observations
IDR	Overall	0.02	0.01	0.00	0.11	N = 675
	Between		0.01	0.00	0.04	n = 75
	Within		0.01	-0.02	0.09	T = 9
ABS	Overall	-0.48	0.70	-2.91	9.13	N = 675
	Between		0.51	-1.48	2.62	n = 75
	Within		0.48	-3.76	6.02	T = 9
ACF	Overall	-0.10	0.23	-0.96	3.47	N = 675
	Between		0.17	-0.47	1.11	n = 75
	Within		0.17	-1.39	2.26	T = 9
BDI	Overall	0.70	0.19	0.00	1.04	N = 750
	Between		0.16	0.18	0.94	n = 75
	Within		0.10	0.23	1.09	T = 10
BSZ	Overall	8.22	1.76	6.00	15.00	N = 750
	Between		1.72	6.70	15.00	n = 75
	Within		0.4	5.22	11.32	T = 10
ISO	Overall	0.67	0.21	0.00	1.00	N = 750
	Between		0.18	0.29	0.96	n = 75
	Within		0.11	0.11	1.02	T = 10
GDD	Overall	0.56	0.87	0.00	4.00	N = 750
	Between		0.78	0.00	3.20	n = 75
	Within		0.39	-0.64	3.76	T = 10
BQI	Overall	-0.78	0.99	-16.83	2.11	N = 750
	Between		0.75	-2.39	1.24	n = 75
	Within		0.65	-15.22	1.75	T = 10
LFS	Overall	16.18	1.49	11.81	20.32	N = 750
	Between		1.45	13.05	19.80	n = 75
	Within		0.40	14.9	17.50	T = 10
LFA	Overall	3.68	0.78	2.08	7.61	N = 750
	Between		0.75	2.50	7.25	n = 75
	Within		0.25	-1.30	4.23	T = 10
BTM	Overall	1.09	2.3	-18.46	21.14	N = 750
	Between		1.83	-8.57	4.55	n = 75
	Within		1.40	-10.12	17.68	T = 10
LVG	Overall	0.32	0.28	0.80	0.99	N = 750
	Between		0.15	0.15	0.71	n = 75
	Within		0.24	0.47	1.21	T = 10

Note: The abbreviations used in the above table are as follows: IND denotes idiosyncratic risk volatility, ABS represents earnings quality measured using the balance sheet approach, and ACF indicates earnings quality measured using the cash-flow approach. BDI stands for board independence, BSZ for board size, ISO for institutional ownership, and GDD for gender diversity. BQI refers to the board quality index, LFS to the natural log of firm size, LFA to the natural log of firm age, BTM to the book-to-market value, and LVG to leverage.

The mean value of board independence (BDI) is 0.69, indicating that all corporations meet Pakistan's corporate governance code, which recommends at least two or one-third of the board members be independent (Farooq et al. 2022). The average board size is 8.21, with a minimum of 6 and a maximum of 15, consistent with the Corporate Governance Guide-

lines 2012. The average institutional ownership is 0.66%, and the average gender diversity score is 0.5, with a maximum of 4, showing compliance with the board's recommendation to include at least one female director.

The board quality index has a mean value of -0.78 , with the lowest and highest levels being -16.83 and 2.11 , respectively. The control variables' average firm size, firm age, leverage, and book-to-market ratio are 16.17 , 3.67 , 0.32 , and 1.09 , respectively. The standard deviation, minimum, and maximum values vary based on the overall, between, and within observations for all variables.

4.2. Correlation Matrix

This study conducted a correlation analysis to examine the dynamic relationships between the response and explanatory variables and check for multicollinearity's likelihood. The findings are presented in Table 3. Upon reviewing the correlation indices, it was found that the study does not suffer from significant multicollinearity issues, except for the correlations between ACF and ABS (0.88) and GDD and BQI (0.70). While perfect multicollinearity can indicate a serious issue or logical error, imperfect multicollinearity (where the correlation coefficient is nearly equal to 1) may be a data characteristic. Therefore, the study does not exclude ACF and GDD when performing the regression analysis.

Table 3. Correlation analysis.

	ABS	ACF	BDI	BQI	BSZ	BTM	GDD	ISO	LFA	LFS	LVG
ABS	1										
	--										
ACF	0.88 **	1									
	49.2	--									
BDI	0.00	0.00	1								
	-0.07	0.01	--								
BQI	0.02	0.00	$-0.22 **$	1							
	0.42	0.06	-5.93	--							
BSZ	0.04	0.04	0.45 **	$-0.4 **$	1						
	1.11	0.93	13.1	-11.4	--						
BTM	0.02	0.00	$-0.13 **$	0.05	$-0.18 **$	1					
	0.61	0.09	-3.43	1.28	-4.82	--					
GDD	0.01	-0.00	$-0.26 **$	0.70 **	$-0.17 **$	-0.00	1				
	0.24	-0.20	-6.97	25.45	-4.57	-0.02	--				
ISO	-0.04	-0.00	$-0.09 *$	$-0.21 **$	0.01	$-0.20 **$	$-0.10 **$	1			
	-1.07	-0.40	-2.40	-5.49	0.26	-4.20	-3.10	--			
LFA	-0.07	-0.00	0.24 **	$-0.15 **$	0.14 **	$-0.10 **$	$-0.20 **$	0.11 **	1		
	-1.77	-0.80	6.35	-3.95	3.71	-1.50	-4.80	2.91	--		
LFS	$-0.23 **$	$-0.20 **$	0.25 **	$-0.16 **$	0.43 **	-0.10	-0.10	-0.00	0.00	1	
	-6.22	-4.30	6.61	-4.25	12.5	-3.10	-1.9	-0.05	1.20	--	
LVG	0.02	0.06	-0.02	-0.02	$-0.08 *$	0.22 **	$-0.1 *$	0.08 *	0.10	-0.10	1
	0.56	1.46	-0.48	-0.60	-2.05	5.79	-2.04	2.03	1.60	-1.50	--

Note: The values reported above are the correlation coefficients and t-statistics. The abbreviations are defined as follows: IND denotes idiosyncratic risk volatility, ABS represents earnings quality using the balance sheet approach, ACF indicates earnings quality using the cash-flow approach, BDI stands for board independence, BSZ for board size, ISO for institutional ownership, GDD for gender diversity, BQI for the board quality index, LFS for the natural log of firm size, LFA for the natural log of firm age, BTM for the book-to-market value, and LVG for leverage. Correlations are significant at the 0.01 (**) and 0.05 (*) levels.

4.3. Panel Unit Root

The panel unit root test examines variables' stationarity properties to ensure the chosen methodology's appropriateness. Chang et al. (2011) noted that testing for stationarity is essential for estimating a dynamic panel data model. Buck et al. (2008) argued that this test is crucial when the number of time-series observations is significantly lower than the number of cross-sectional units. Consequently, this study conducted a series of panel unit root tests to provide unbiased, valid, and reliable estimates. The panel unit root test was

performed at both the level and first difference, based on four different criteria: (i) the Levin, Lin, and Chu (LLC) t -statistic, (ii) the IPS, (iii) the ADF–Fisher, and (iv) PP–Fisher χ^2 , following the methodology of Chen et al. (2012) and Olaniyi et al. (2017). It is important to note that LLC and Breitung assume a common unit root, while IPS, ADF–Fisher, and PP–Fisher χ^2 assume individual unit root processes across cross-sectional units.

Table 4 presents the findings of the panel unit root test at both the level and first difference based on the mentioned criteria. The results indicate that all variables attain stationarity at the level, except for board and firm size. Conversely, all variables achieve stationarity at the first difference except for board size and firm age. Since most variables are significant at the first difference, the current study employs the generalised method of moments (GMM) framework proposed by Arellano and Bond (1991) to estimate the abovementioned four models.

Table 4. Panel unit root tests.

	At Level				At First Difference			
	LLC	IPS	ADF–Fisher	PP–Fisher	LLC	IPS	ADF–Fisher	PP–Fisher
IDR	−11.20 0.00	−2.71 0.00	212.43 0.00	306.50 0.00	−24.73 0.00	−7.74 0.00	336.79 0.00	664.74 0.00
ABS	−14.95 0.00	−4.90 0.00	261.42 0.00	513.87 0.00	−17.53 0.00	−7.54 0.00	331.39 0.00	731.35 0.00
ACF	−19.02 0.00	−6.07 0.00	288.19 0.00	530.66 0.00	−24.14 0.00	−9.06 0.00	366.98 0.00	759.89 0.00
BDI	−7.22 0.00	−0.61 0.27	164.85 0.09	201.72 0.00	−23.03 0.00	−6.70 0.00	286.36 0.00	634.64 0.00
BSZ	−2.02 0.02	−0.09 0.47	27.01 0.52	54.69 0.00	−1.00 0.16	−1.85 0.03	29.85 0.02	104.68 0.00
ISO	−10.33 0.00	−4.45 0.00	254.64 0.00	311.95 0.00	−17.7 0.00	−8.45 0.00	347.51 0.00	633.27 0.00
GDD	−5.58 0.00	−1.41 0.08	37.01 0.04	34.93 0.07	−4.20 0.00	−2.11 0.02	35.15 0.01	74.79 0.00
BQI	−20.44 0.00	−3.41 0.00	198.83 0.00	296.52 0.00	−12.1 0.00	−5.06 0.00	268.75 0.00	669.91 0.00
LFA	−101.94 0.00	−903.75 0.00	1344.71 0.00	1344.71 0.00	119376 1.00	−894.13 0.00	1344.71 0.00	1344.71 0.00
LFS	−3.77 0.00	3.95 1.00	119.61 0.97	173.01 0.10	−9.43 0.00	−3.12 0.00	224.69 0.00	396.82 0.00
LVG	−6.91 0.00	−2.37 0.01	200.97 0.00	294.95 0.00	−15.32 0.00	−6.47 0.00	311.24 0.00	704.63 0.00
BTM	−8.17 0.00	−0.77 0.22	166.15 0.17	217.01 0.00	−12.68 0.00	−3.98 0.00	237.05 0.00	477.55 0.00

Note: IND, ABS, ACF, BDI, BSZ, ISO, GDD, BQI, LFS, LFA, BTM, and LVG represent idiosyncratic risk volatility, earnings quality using the balance sheet approach, earnings quality using the cash-flow approach, board independence, board size, institutional ownership, gender diversity, board quality index, natural log of firm size, natural log of firm age, book-to-market value, and leverage, respectively. The reported values are the t -statistics and their corresponding p -values. LLC, IPS, ADF–F, and PP–F stand for the following tests: (1) Levin, Lin, and Chu, (2) Im, Pesaran, and Shin W -stat, (3) ADF–Fisher Chi-square, and (4) PP–Fisher Chi-square.

4.4. Regression Results

As shown in Table 5, four models are estimated using different independent variables. This study employs two approaches for measuring earnings quality. These approaches are estimated separately alongside corporate governance (CG) attributes in the first two models. Models 3 and 4 introduce the board quality index and two control variables—leverage and book-to-market ratio—into the regression equation instead of CG characteristics. All independent and firm-level control variables are included in models 3 and 4 (see Table 5). The findings in Table 5 support Hypothesis 1 (H1), indicating that earnings quality significantly correlates with idiosyncratic return volatility. These outcomes are consistent with earlier studies (Aman 2011; Mitra 2016; Hutton et al. 2009). Mitra (2016) also documented

similar results, arguing that these findings align with the noise hypothesis, which suggests that higher earnings quality leads to lower idiosyncratic return volatility. Further, Morck et al. (2000) and Hutton et al. (2009) stated that outside stakeholders have limited access to firm-specific information when a corporation's financial reporting quality is poor. As a result, they must make investment decisions based on industry or market-level public information, leading to lower idiosyncratic return volatility for such organisations.

Table 5. Impact of EQ and CG indicators on idiosyncratic risk volatility.

Variable	Model_01		Model_02		Model_03		Model_04	
	Co-eff.	t-Stat	Co-eff.	t-Stat	Co-eff.	t-Stat	Co-eff.	t-Stat
IDR Lag	−0.19 ***	−2.83	−0.20 ***	−3.15	−0.20 ***	−3.25	−0.20 ***	−3.36
ABS	0.01 **	1.82			0.00	0.89		
ACF			0.06	1.52			0.02	0.53
BDI	−0.08 **	−2.19	−0.07 **	−2.04				
BSZ	0.02	1.14	0.02	1.39				
ISO	0.00	0.04	0.01	0.42				
GDD	0.01	−0.76	0	−0.70				
BQI					0.00	−0.88	0.00	−0.8
LFA	−0.09 ***	−2.86	−0.10 ***	−2.86	−0.06 **	−2.40	−0.06 *	−1.97
LFS	0.02 **	2.51	0.02 **	2.39	0.01 **	2.05	0.01 *	1.74
LVG					0.00	−0.88	0.00	−0.84
BTM					0.00	0.60	0.00	0.65
J-statistic		12.37		13.8		17.57		18.57
Prob(J-statistic)		0.82		0.74		0.55		0.48
Instrument rank		27.00		27.00		27.00		27.00
Arellano-Bond Serial Correlation Test								
AR (1)								
M-Statistic	−2.83		−2.57		−3.33		−2.91	
Prob.		0.00		0.01		0.00		0.00
AR (2)								
M-Statistic	−1.39		−0.39		−0.54		−0.28	
Prob.		0.16		0.69		0.58		0.77

Note: The second lag of IDR is reported. ***, **, and * indicate significance levels at 1%, 5%, and 10%, respectively. The first difference transformation is applied for the panel GMM, and if the innovations are i.i.d., the transformed innovations follow an integrated MA (1) process. Seventy-five cross-sections are included in all four models, with a total of 450 balanced panel observations. Two lags of the dependent variables are used, and the second lag is reported in all four models. The lagged dependent variables are specified as regressors, and period dummy variables (period fixed effects) are not included. This study uses 2-step (update weights once) GMM iterations with the White period. This research has carefully considered these GMM limitations and ensured our empirical analysis's robustness.

Furthermore, this study also examines the influence of corporate governance (CG) attributes and the board quality index on idiosyncratic return volatility. The results indicate that only board independence has a negative and statistically significant impact on idiosyncratic return volatility, supporting Hypothesis 2 (H2). These findings are consistent with existing literature (Hussain and Shah 2017). Jiraporn and Lee (2018) argue that board independence helps develop an efficient governance system that discourages executives from making highly risky decisions. Similarly, Fareed et al. (2022) found that improved board independence reduces the likelihood of violations and connected transactions, such as illegal insider trading. Based on these studies, it is evident that board independence plays a critical role in governance mechanisms. Consequently, regulatory authorities worldwide have recognised its necessity and implemented regulations requiring a higher ratio of outside directors, such as the Sarbanes-Oxley Act of 2002 (SOX). Additionally, Anderson et al. (2004) documented that the presence of independent directors improves the validity of financial information and reduces financing costs, thereby decreasing stock price volatility.

The results indicate that board size, institutional ownership, and gender diversity do not have a statistically significant impact on idiosyncratic return volatility. As a result, the findings do not support H3, H4, and H5. The results of the study suggest that corporate governance mechanisms in emerging countries like Pakistan have an inconsistent influence on financial outcomes, and these findings are in line with the extant literature (see Swan and Forsberg 2014; John and Senbet 1998; Asghar et al. 2020; Patrick et al. 2015; Arya et al. 2003; Ghafoor et al. 2019; Akbar et al. 2017).

The study also includes four firm-level characteristics as control variables: size, age, book-to-market ratio, and leverage, drawn from previous studies (Zhou et al. 2017; Chen et al. 2012; Mitra 2016). The empirical outcomes in Table 5 reveal that only two control variables, firm size and age, are significantly aligned with the literature (Mitra 2016; Chen et al. 2012; Zhou et al. 2017). Firm size has an inverse and significant relationship with idiosyncratic return volatility, suggesting that smaller corporations have limited capacity to manage risks, while larger corporations have more pre-disclosure information available before earnings announcements (Rajgopal and Venkatachalam 2011; Brandt et al. 2010). Similarly, firm age also has an inverse and statistically significant correlation with idiosyncratic return volatility, indicating that younger corporations tend to have higher earnings uncertainty and, thus, greater idiosyncratic risk (Chen et al. 2012; Fareed et al. 2022).

5. Conclusions

The influence of corporate governance and earnings quality on idiosyncratic risk is a crucial finance study area. Idiosyncratic risk refers to the hazard inherent to a specific firm, independent of broader market movements. The existing literature (Cardoso et al. 2019; Fareed et al. 2022; Hussain and Shah 2017; Mitra 2016; Wu et al. 2020) reveals that corporate governance practices and earnings quality can impact idiosyncratic risk through different channels. This study identified a gap in this empirical literature since these studies have not addressed this issue collectively. To fill this gap, our study explores the impact of corporate governance and earnings quality on idiosyncratic risk within the context of developing countries, using data from 75 non-financial sector firms listed on the Pakistan equity market from 2010 to 2018. Our empirical estimation reveals that some corporate governance practices influence idiosyncratic risk.

Further, our empirical analysis reveals that higher earnings quality mitigates the idiosyncratic risk. These results support the noise hypothesis, demonstrating that better earnings quality leads to lower idiosyncratic risk. The outcomes of this study highlight the crucial role of some strong corporate governance mechanisms in emerging countries in risk management and contribute to a deeper understanding of idiosyncratic risk in corporate finance. Recognising and managing these interdependencies as corporations navigate an increasingly complex financial landscape is critical for informed decision-making and effective risk mitigation.

6. Scope for Future Studies

It is acknowledged that our study utilised data from 75 non-financial Pakistani firms, which may limit the generalisability of the results to other economies. As a future research direction, we recommend expanding this empirical investigation to include the latest dataset from global data sources. This would enhance the generalizability of the findings to different countries and markets. Additionally, including the R&D intensity as a control variable is suggested in future empirical models, subject to the data's availability.

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Appendix A. Variables, Abbreviations and Their Definitions

Variable	Abbreviation	Definition
Idiosyncratic Risk	IDR	See Equation (5) in Section 3
<i>Earnings Quality</i>		
Accrual Quality	ABS	See (Mitra 2016)
Absolute Abnormal Accruals	ACF	See (Dechow and Dichev 2002)
<i>Corporate Governance</i>		
Board Independence	BDI	The ratio of non-executive directors to total directors on board
Board Size	BSZ	Total members on the board
Institutional Ownership	ISO	The proportion of shares held by the institution to the total shares outstanding
Gender Diversity	GDD	Ratio female directors to total directors
Board Quality Index	BQI	It is measured through PCA by using corporate governance indicators e.g., BDI, BSZ, ISO, and GDD.
<i>Control Variables</i>		
Firm Age	LFA	Total number of years since the business established
Firm Size	LFS	Ln (Total asset)
Leverage	LVG	The proportion of debt to equity
Book-to-market ratio	BTM	The proportion of book value of equity to market value of equity

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Article

ESG Performance and Systemic Risk Nexus: Role of Firm-Specific Factors in Indian Companies

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Abstract: This study investigates the ESG performance–systemic risk (SR) nexus among Indian companies. Using the beta coefficient from the Capital Asset Pricing Model (CAPM) and statistical analysis, it explores how ESG performance affects SR. The findings reveal that firms with higher ESG scores have lower SR sensitivity. Notably, there is a significant difference in risk sensitivity between high- and low-ESG-rated companies, with ESG effects being less pronounced in high-cap firms compared to low-cap firms. Conversely, large firms, older firms, and those with lower borrowing costs show a diminished effect of ESG ratings on their SR sensitivity. These results underscore the importance of firm-specific characteristics in determining the efficacy of ESG strategies in risk mitigation. This study reveals that ESG performance reduces SR, with market valuation affecting this relationship.

Keywords: ESG performance; systemic risk; firm size; cost of debt; firm age; systemic risk sensitivity; Capital Asset Pricing Model

1. Introduction

Over the past few years, the ESG framework has emerged as a focal point of global discourse, reflecting an era where the corporate impact on society undergoes rigorous scrutiny (Gramlich and Finster 2013; Gupta and Chaudhary 2023). Stakeholders exert relentless pressure on enterprises to adopt and operationalize ESG practices, compelling them to navigate responsibly amidst societal expectations and environmental imperatives (Jain and Tripathi 2023). Consequently, firms are increasingly urged to embrace sustainable operations that integrate societal rights and ecological stewardship (Principles for Responsible Investment 2015). The tripartite pillars of ESG—environmental, social, and governance—organize sustainability efforts within corporations. The environmental facet addresses the enterprise’s ecological footprint and commitment to environmental stewardship. Social dimensions encompass stakeholder relations and value creation, while governance spans the policies, practices, and managerial ethos within organizations (Duque-Grisales and Aguilera-Caracuel 2021).

Examination of how ESG factors affect firm performance has been extensively explored in business and economic research (Wu et al. 2022). This is because it aids institutional investors in identifying, evaluating, and managing the investment risks and opportunities linked to significant ESG issues (Global Sustainable Investment Alliance 2020). Over the past few years, there has been a substantial rise in the number of investors and policymakers engaged in socially responsible investment (Giese et al. 2019), thereby increasing the focus on ESG considerations and their impact on company profitability (Aydoğmuş et al. 2022) and financial stability (Porta 2024). Traditionally, corporate managers and policymakers have depended on fundamental corporate data and market technical information. ESG data now provides an additional layer of insight into future performance, helping investors

make informed decisions (Global Sustainable Investment Alliance 2020). An increasing number of studies have delved into the methods for measuring ESG and ranking companies accordingly (Billio et al. 2021), as well as examining how ESG factors influence financial performance (FP) and risk management (Verheyden et al. 2016; Torricelli and Bertelli 2022; Yadav and Saini 2023). Numerous studies have sought to summarize these diverse findings (Fulton et al. 2012). Scientific inquiry into integrating ESG metrics into portfolio management aims to optimize financial outcomes. Extensive empirical analysis across a comprehensive corpus of studies, encompassing over a thousand scholarly investigations, has unveiled a nuanced tapestry of correlations between ESG attributes and financial performance (FP). These findings underscore a spectrum of outcomes: positive, negative, and statistically insignificant relationships. Nevertheless, a prevailing consensus emerges from the literature, revealing a predominance of studies asserting a robustly positive association (Global Sustainable Investment Alliance 2020).

Taking risks at the individual company level can significantly propel the growth of corporate assets, thereby fortifying a firm's key competitive strengths (John et al. 2008). On a broader perspective, increased risk-taking within the economy and society reflects a larger investment of capital into innovation (Low 2009), which fuels sustained economic growth over time (Baumol and Strom 2007). Numerous studies have previously delved into the determinants of corporate risk-taking by examining both the internal and external characteristics of firms. These studies have analyzed risk-taking behavior by considering various factors such as the ownership structure (Faccio et al. 2011; Kamaruzaman et al. 2019), CEO traits (Faccio et al. 2016), internal governance mechanisms (Anantharaman and Lee 2014), legal frameworks (Acharya et al. 2011), and cultural variances (Li et al. 2013). As these attributes evolve, companies' risk-taking behaviors continuously adjust in response to changes in their internal and external environments (Gopalan et al. 2021).

Given the varied findings on how ESG factors impact FP, this study advances a novel conceptual framework elucidating the influence of ESG performance on a company's susceptibility to SR, focusing on companies listed in Indian market, characterized by rapid economic expansion and distinct environmental and social challenges. The study seeks to reveal how ESG performance affects sensitivity to systemic risk (SR), thereby deepening our understanding of the Indian financial milieu and enriching the global ESG discourse. This paper examines the roles of firm size, firm age, and cost of debt (K_d) in an ESG-SR sensitivity nexus. Given India's status as the fifth-largest economy globally and its significant role in the international financial system, understanding this interaction is vital. The study underscores the potential of ESG practices in India to mitigate systemic risks and aims to develop an integrated framework for incorporating ESG factors into risk management practices within India's evolving economic landscape.

The results of this study carry considerable implications for policymakers in India, guiding them to refine current regulations or develop new policies to enhance sustainability as well as financial stability. Investors can also gain valuable insights from this research, improving their understanding of the financial repercussions of ESG practices in India, which can influence their investment choices, risk assessments, and asset allocation strategies.

The structure of this manuscript unfolds methodically: Section 2 reviews the pertinent literature, offering a nuanced synthesis of scholarly contributions. In Section 3, employing rigorous quantitative analysis, we scrutinize the intricate nexus between a firm's susceptibility to SR and its ESG performance. Section 4 delineates and cogently interprets our empirical findings. Moving to Section 5, we delve into the intricate dynamics where market valuation exerts profound influences on both SR exposure and ESG metrics. Finally, Section 6 transcends mere analysis to deliberate upon profound implications, methodological constraints, and prescient avenues for future inquiry in this domain.

2. Literature Review

2.1. Theoretical Background

Three prominent theories elucidate the relationship between ESG practices and firm risk, as discussed by Bouslah et al. (2018): (i) the stakeholder theory, (ii) models that analyze the connection between social performance and expected returns, and (iii) the Managerial Opportunism Theory.

Stakeholder theory suggests that increased investments in ESG can generate goodwill or moral capital among stakeholders, functioning similarly to an insurance mechanism that reduces firms' exposure to various risks, including operational, environmental, and social risks (El Ghouli and Karoui 2017). According to this theory, firms engaged in socially responsible activities build trust and loyalty with their stakeholders, which can serve as a cushion against adverse events. This moral capital helps firms during crises, lowers the cost of capital, and enhances long-term value (Löffler 2023).

Theoretical models concerning expected return and social performance suggest that investors incorporate both non-financial and financial metrics into their investment strategies. Companies demonstrating robust CSR tend to attract a broader investor base that is drawn to their ethical conduct, thereby mitigating investment risks (Lee and Faff 2009). The correlation between social performance and expected return underscores that enterprises excelling in ESG metrics enjoy enhanced investor confidence, fostering stability in financial markets by reducing volatility and promoting sustained economic resilience.

Managerial Opportunism Theory, on the other hand, argues that expenditures on CSR can be a misuse of resources, thus decreasing the net worth of the firm—a view aligned with overinvestment (Barnea and Rubin 2010; Jo and Na 2012). This perspective, however, is less supportive of the positive impact of ESG performance on risk mitigation, which is the focus of this research.

This paper primarily employs the first two theories to elucidate the intricate ESG-firm risk nexus. However, within the broader context of market contagion, ESG practices are seen as pivotal in attenuating adverse systemic effects, leading to the intrinsic property of ESG funds to lower SR (). Consequently, this research also intersects with Signal Transmission Theory and Consumer Behavior Theory.

Consumer Behavior Theory (CBT) investigates the decision-making processes of individuals when they purchase goods or services, considering psychological, social, and economic factors. In the context of ESG performance, CBT suggests that consumers increasingly value sustainable and ethical practices. Firms excelling in ESG criteria are perceived more favorably, enhancing their market value and hence market capitalization and reducing SR. The rising awareness of environmental and social issues drives consumers to prefer companies that align with their values (Solomon 2018). From a risk perspective, CBT highlights the preference of consumers for products from firms with strong ESG records. Such firms tend to have lower financing costs and attract fewer speculative investors, thus reducing SR, especially during market downturns (Panigrahi et al. 2018).

Signal transmission theory (SGT), derived from information economics, examines how information asymmetries between parties can be reduced through signaling. Companies signal their quality and trustworthiness to investors, consumers, and other stakeholders through their ESG disclosures. Effective ESG reporting indicates the commitment of a firm to sustainable practices, reducing perceived risks and attracting investments. This signaling enhances transparency and reduces information asymmetry, thereby contributing to a company's reputation and market stability (Spence 1973).

In essence, drawing from signal transmission theory, we discern two distinct paths of communication. In the domain of product and service markets, when a company achieves a high ESG rating, strategic ESG insights are conveyed to consumers as a signal through corporate announcements or disclosures by ESG rating agencies. This amplifies the intangible value of the firm's offerings, leading to heightened consumer satisfaction at the same price point. Consequently, consumer loyalty strengthens over time, bolstering the company's resilience to industry challenges and diminishing its susceptibility to SR

(Farah et al. 2021). In the realm of investments, companies have the opportunity to unveil their ESG strategies, signaling their industry risk exposure and prowess in managing idiosyncratic risks to investors. This highlights their commitment to sustainable practices, attracting investors who prioritize ESG factors and reshaping the dynamics of trading at a microstructural level.

Within the investment landscape, firms strategically disclose their ESG initiatives and performance through various channels, including corporate announcements and reports from ESG rating agencies. This deliberate dissemination aims to build a positive corporate identity and emphasize the company's intangible assets. These positive signals influence the share market by shaping investor decisions. Companies with strong ESG ratings gain visibility in ESG reports and provide comprehensive risk disclosures (Chodnicka-Jaworska 2021; Saci et al. 2024). This fosters confidence and trust among investors, decreasing share price volatility. A stable group of investors can counteract speculative behaviors, thereby lowering SR and supporting the firm's long-term growth (Capelle-Blancard and Petit 2019).

By integrating CBT and SGT, this research aims to examine how ESG performance, as a signal, affects consumer behavior and, subsequently, a firm's sensitivity to SR. High ESG performance may serve as a positive signal to consumers and investors, fostering increased trust and lower perceived risk. By combining stakeholder theory, theoretical models on social performance and expected returns, CBT, and SGT, this study seeks to provide a comprehensive understanding of how ESG practices can mitigate systemic risks and enhance financial stability in the Indian market.

2.2. Systemic Risk (SR)

Systemic risk (SR) embodies the potential for a systemic collapse within a network triggered by the failure of a single constituent or due to exogenous disturbances. This concept can be likened to a chain reaction, akin to a row of dominoes, where the collapse of one leads to the fall of the entire sequence (Eratalay and Cortés Ángel 2022; Dziwok et al. 2023). In this context, the system under consideration is the share market. The relationship between SR in share market and the broader economy is grounded in the notion that the share market constitutes a substantial portion of an economy (Neitzert and Petras 2019).

This correlation is particularly pronounced when the share market comprises numerous stocks, substantial market capitalizations, and extensive representation across various industries. Numerous studies have utilized share markets for the assessment of SR. Liu et al. (2020) examined the share market indices from 43 different nations to reflect global financial markets, Zhao et al. (2019) concentrated on SR within the share market of China, and Hakan Eratalay and Vladimirov (2020) explored the share market of Russia.

Several methods have been devised to assess SR. Acharya et al. (2017) quantified SR and proposed a taxation policy designed to optimally manage it. Gray et al. (2007) utilized a risk-adjusted balance sheet and contingent claims analysis to examine asset-liability discrepancies across corporate, financial, sovereign, and household sectors showcasing systemic instability through stress testing. Tobias and Brunnermeier (2016) introduced conditional VaR metrics to assess both the individual and systemic risks that entities impose on the system. Tarashev et al. (2010) employed a game theory strategy, specifically the Shapley value approach, to measure a bank's risk contribution by aggregating its marginal impacts on the banking system.

Researchers have made a distinction between the contribution to SR and the exposure to it for individual companies. Billio et al. (2012) employed principal component analysis, leveraging return covariance matrices to discern commonalities in returns, particularly during periods of market instability. This approach helps identify both the contribution and exposure of firms to SR.

In context of the Capital Asset Pricing Model, Ruefli et al. (1999) undertook a seminal examination into a firm's sensitivity to SR, specifically delving into the intricate interplay between beta and the firm's FP. Their analysis delineated two pivotal roles of beta within the CAPM framework: firstly, as a metric capturing a company's exposure to systemic

risk; secondly, as a conduit that translates the equity risk premium into the requisite rate of return tailored to the unique characteristics of an individual firm. We incorporate this methodological approach into our study owing to its discernible simplicity and profound efficacy in navigating the complexities inherent to equity valuation under systemic risk considerations.

2.3. ESG and SR

Our research is driven by three primary motivations: (1) ESG investing's efficacy in mitigating stakeholder risk, (2) its advocacy for prolonged investment horizons, and (3) its focus on a relatively underexplored market segment.

Firstly, ESG investing is intricately linked with the diminution of stakeholder-related risks. Becchetti et al. (2018) expound upon the stakeholder theory, asserting that firms with subpar ESG ratings are particularly susceptible to litigation and stakeholder-associated risks. In a market equilibrated by investor preferences, companies boasting superior ESG ratings generally exhibit lower systemic risk (SR), as posited by Albuquerque et al. (2019), which often translates into diminished anticipated stock returns. Furthermore, the empirical evidence presented by Becchetti et al. (2015b) and Löff et al. (2022) indicates that firms extensively engaged in CSR activities and characterized by reduced stakeholder risk tend to manifest elevated idiosyncratic risk. Corroborating this, research by Kim et al. (2014), da Silva (2022), and Yu et al. (2023) elucidates that firms adhering to stringent transparency standards are less likely to obfuscate adverse news, thereby mitigating their crash risk exposure. Similarly, Boubaker et al. (2020) and Singh (2024) have observed that entities with exemplary ESG ratings encounter a reduced risk of financial distress, rendering them less prone to financial default.

Secondly, ESG funds epitomize a paradigm shift towards long-term investment strategies, exhibiting a remarkable resilience against the allure of short-term risk and return fluctuations (Bollen 2007). The sustained interest in ESG assets is predominantly fueled by investor preferences, where investors demonstrate a pronounced aversion to divesting these assets even amidst financial crises (Becchetti et al. 2015a). This phenomenon is aptly elucidated through the multi-attribute utility function of socially responsible investors, which intricately weaves ethical considerations into their investment calculus (Bollen 2007).

Thirdly, funds boasting robust ESG ratings strategically curate their portfolios to predominantly encompass assets that rigorously adhere to ESG standards (Joliet and Titova 2018). This approach facilitates the exploitation of niche market segments, often overlooked by conventional investment funds. This strategic concentration is congruent with the heightened idiosyncratic risk associated with companies possessing high ESG scores, as observed by Becchetti et al. (2015b). As a result, ESG-centric funds demonstrate a reduced correlation with other investment portfolios, thereby mitigating the risk of contagion and enhancing portfolio diversification.

Cumulatively, these dynamics delineate the ESG investment sector as one inherently geared towards overall risk mitigation (Cerqueti et al. 2021). During episodes of market contagion, ESG investments manifest a capacity to ameliorate adverse impacts. The predilection for ESG assets among investors plays a pivotal role in mitigating contagion risk, thereby endowing ESG funds with an intrinsic capability to attenuate systemic risk (SR).

Companies with exemplary ESG ratings are predisposed to adopting judicious and sustainable practices, thereby attenuating their risk exposure. (Cerqueti et al. 2021) posit that ESG investment has the potential to mitigate systemic risk, asserting that firms adhering to ESG standards are less vulnerable to systemic shocks due to enhanced governance transparency. Furthermore, they emphasize that ESG-oriented investments inherently prioritize long-term perspectives, thereby diminishing the propensity for panic selloffs during periods of crisis. ESG assets, not yet ubiquitously embraced, demonstrate a lower susceptibility to market disruptions. In a complementary study, Leterme and Nguyen (2020) discovered that ESG factors could be conceptualized as integral components of systemic risk. The extant literature presents a spectrum of findings regarding the nexus

between ESG ratings and financial performance, with some studies reporting neutral or adverse impacts, while others document positive correlations. For example, Sassen et al. (2016) identified that superior corporate social performance correlates with a reduction in both overall and specific risks. Value-driven investment strategies, encompassing socially responsible investing and ESG investing, eschew industries such as tobacco, arms, and gambling, and rigorously assess companies based on their sustainability practices and risk management frameworks.

Based on our literature analysis, it is clear that superior ESG performance can serve as a protective shield against SR for corporations. Drawing from these insights, this paper proposes new hypotheses for further investigation:

H₁: *A robust ESG performance score among corporations may dampen their susceptibility to SR.*

2.4. ESG, SR, and Firm Size

The interplay between ESG ratings and SR can vary significantly based on a size of a firm. Larger firms often exhibit more stability and resource resilience, which can buffer against various risks, including systemic ones. These firms typically have established reputations and diversified portfolios, which may mitigate the impact of ESG ratings on their risk profiles. Conversely, smaller firms may not have the same level of risk mitigation mechanisms in place, making them more sensitive to changes in ESG ratings.

Previous research has suggested that while high ESG scores can reduce overall risk, the effect is more pronounced in firms that lack the inherent stability provided by a large firm size (Saci et al. 2024). Therefore, we hypothesize that:

H₂: *ESG ratings have a less pronounced impact on the sensitivity of SR for large firms compared to small and mid-sized firms.*

2.5. ESG, SR, and Firm Age

The influence of ESG ratings on SR in relation to the age of a firm is an area that has not yet been extensively explored in the existing literature. Traditional studies on ESG and firm risk often focus on FP and stakeholder relations, but the variable of firm age introduces a novel perspective (Eratalay and Cortés Ángel 2022; Pistolesi and Teti 2024; Saci et al. 2024).

Older firms typically possess more established processes, experienced management teams, and a robust historical presence in their respective markets, potentially granting them resilience against SRs (Liu et al. 2022). This stability might mean that the impact of ESG ratings on their SR sensitivity is less pronounced. Conversely, younger firms, which are in the stages of growth and development, might be more susceptible to systemic risks due to less mature operational frameworks and less entrenched market positions (Dungey et al. 2022).

This study seeks to fill this gap by examining whether the SR reduction benefits of high ESG ratings are more significant for younger firms compared to older firms, thereby proposing the following hypothesis:

H₃: *ESG ratings have a less pronounced impact on the sensitivity of SR for older firms compared to younger firms.*

2.6. ESG, SR, and Cost of Debt

The ESG-SR nexus in the context of a firm's cost of debt (K_d) is another underexplored area in current research. Previous studies have primarily focused on the broader impacts of ESG performance on financial stability and risk management without delving into how the K_d might modulate these effects (Eratalay and Cortés Ángel 2022; Pistolesi and Teti 2024).

A low K_d provides firms with the financial stability and flexibility needed to proactively manage and mitigate various risks (Porta 2024). This advantage allows them to act as a buffer, maintaining operations and pursuing growth even in the face of adverse conditions (Dungey et al. 2022). This financial cushion might render the impact of ESG ratings on SR sensitivity less significant for such firms. On the other hand, firms with a

high K_d are generally more financially vulnerable (Dungey et al. 2022) and may face greater pressures to manage risks effectively. High ESG performance could thus play a critical role in enhancing their creditworthiness and reducing SR. This research aims to pioneer the examination of how ESG ratings interact with the K_d to influence SR, hypothesizing that:

H₄: *ESG ratings have a less pronounced impact on the sensitivity of SR for firms with a low cost of debt compared to those with a high cost of debt.*

3. Research Methodology

3.1. Sample

The sample for our study comprises companies enlisted in the Bombay Stock Exchange's (BSE's) flagship S&P BSE 500 index, representing approximately 93 per cent of the total market capitalization on the BSE. Our sample includes 428 firms after excluding 72 firms due to missing data. The study period spans from 1 April 2018 to 31 March 2024. Data are collected on an annual basis to ensure the analysis captures trends and patterns accurately. We have selected this timeframe because it provides the most recent and relevant data, reflecting the latest trends in ESG practices among Indian firms. This period is long enough to identify significant patterns and trends while ensuring data consistency and availability, as ESG reporting has become more standardized in recent years.

3.2. Data Analysis Method

To gauge the sensitivity to SR, the beta coefficient derived from CAPM is employed, utilizing Stata[®] 16 software. Panel data estimation is employed as the analytical framework for this study.

3.3. Data

This study's primary dataset is sourced from the Prowess database of the Centre for Monitoring Indian Economy (CMIE ProwessIQ Database), an esteemed repository for firm-level analysis of Indian enterprises (Gidage and Bhide 2024b; Beloskar and Rao 2022; Dharmapala and Khanna 2018). ESG ratings as of March 2024 for the sample companies were obtained from Thomson Reuters, adhering to methodologies established in previous research (Gidage et al. 2024; Gidage and Bhide 2024a; Ioannou and Serafeim 2012; Liu et al. 2024; Sensharma et al. 2022).

Firm performance across ESG dimensions is evaluated using Asset4's three-pillar scores. These scores, scaled from 0 to 100, serve as robust indicators of a company's ESG performance and are widely endorsed in scholarly discourse. Thomson Reuters supplies the Asset4 performance scores, facilitating a comparative analysis of a company's performance on an array of ESG metrics within the Asset4 universe, with higher scores denoting superior ESG performance (de Villiers et al. 2022).

Thomson Reuters' ESG evaluations encompass over 7000 global companies, with a historical dataset extending back to 2002. These assessments are presented as percentile ranks, interpretable both as percentages and letter grades, ranging from A+ to D−. The rankings are congruent with the Thomson Reuters Business Classifications (TRBCs) Industry Group for Environmental and Social factors and are harmonized with national standards for governance criteria. The revamped ESG metrics convert these percentile figures into letter grades, making it easier to quickly assess how a company measures up against its industry peers, highlighting areas of excellence and concern in their ESG practices (Thomson Reuters ESG Scores 2018). Table 1 provides a detailed guide on how scores are translated into letter grades.

Table 1. ESG score and respective grades.

Score Range	Grade
0.0 to 0.0833	D–
0.0833 to 0.1667	D
0.1667 to 0.25	D+
0.25 to 0.3333	C–
0.3333 to 0.4167	C
0.4167 to 0.5	C+
0.5 to 0.5833	B–
0.5833 to 0.6667	B
0.6667 to 0.75	B+
0.75 to 0.8333	A–
0.8333 to 0.9167	A
0.9167 to 1.0	A+

Source: Thomson Reuters ESG Scores (2018).

3.4. Variables

In this study, the focal point of analysis is the degree of sensitivity to SR, a crucial variable gauged by the ratio of listed companies' stock return volatility against the broader market's fluctuations, as per asset portfolio theory. To quantify this sensitivity, the beta coefficient derived from the CAPM serves as a reliable measure, indicating the magnitude of SR sensitivity across the asset portfolio (Ruefli et al. 1999).

The beta coefficient from the CAPM is utilized to quantify SR sensitivity, expressed as:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f] \quad (1)$$

$$\text{Beta}_i(\beta_i) = \frac{\text{cov}(R_i, R_m)}{\text{var}(R_m)} \quad (2)$$

Here, we delineate R_i as the return on assets for firm i , with R_f representing the risk-free rate of return and R_m signifying the return of the market portfolio. The focal point of our investigation centers on β_i , symbolizing the systemic risk (SR) sensitivity of firm i . Notably, β serves as our notation for the SR-dependent variable.

The ESG performance scores (ESGPSs) used in the analysis correspond to the same year as the dependent variable (i.e., the same year in which SR sensitivity is measured) to accurately reflect the potential impact of ESG practices on systemic risk.

Table 2 provides a detailed description of the dependent, independent, and control variables used in the analysis.

Our selection of variables is scrupulously grounded in an extensive synthesis of pivotal prior research, notably including Dhaliwal et al. (2016), Hwang et al. (2017), Mardini (2022), Saci et al. (2024), and Teplova et al. (2024). Distinctively, our study pioneers the inclusion of variables such as the return on capital employed, cost of debt, firm age, and firm size that have heretofore been conspicuously absent in the empirical investigation of the ESG-SR nexus. These variables are integrated for the first time in our analysis, offering an unprecedented perspective on the multifaceted dimensions of how ESG performance interacts with firm-specific characteristics to influence systemic risk. By incorporating these previously unexplored variables, our study not only enriches the existing body of knowledge but also provides a more comprehensive understanding of the intricate dynamics between ESG factors and financial stability across different types of firms.

Table 2. Description of variables.

Type of Variable	Name of Variable	Symbol	Definition
Dependent Variable	Systemic Risk	β	Beta of a security is determined by taking the covariance of the security's returns and the market's returns and dividing it by the variance of the market's returns over a specified period
Independent Variable	ESG Performance Score	ESGPS	Thomson Reuters ESG performance scores
Dummy Variables	Firm Size (for Dummy)	FS_DUMMY	Divided into DUM_Q1 (Small Firms); DUM_Q2 (Mid-sized Firms); DUM_Q3 (Large Firms). More details in Section 4.3
	Firm Age	FA	In the text, the age of companies is represented as a dummy variable: a value of 1 indicates high age, while a value of 0 indicates low age
	Cost of Debt	CoD	CoD is the ratio of interest expenses of a firm to its average debt. Here, a value of 1 indicates high CoD, while a value of 0 indicates low CoD
Control Variables	Firm Size (for Control)	FS	Natural logarithm of firm's total assets at the end of the year
	Cash Flow	CF	It is equal to the cash inflow generated by the company through specific economic activities
	Return on Assets	RoA	(Net Income/Total Assets) * 100%
	Firm Size	FS	Natural log of firm's total assets
	Leverage	LEV	Total Debt/Total Equity
	Relative Issue Price (increase/decreases)	RP	The relative increase or decrease in the issue price is calculated as: ((closing price on the specified trading day – starting price)/(starting price)) * 100%
	Return on Capital Employed	RoCE	EBIT divided by invested capital
	Capital Output	CO	It is equal to the sum of the enterprise's strategic investments and its rolling investments

4. Data Analysis, Results, and Discussions

4.1. Descriptive Statistics

Table 3 presents descriptive statistics revealing the expansive range of values observed across the variables studied, thereby encapsulating the diverse profiles of the analyzed firms. The mean SR (β) stands at 0.630, accompanied by a notable standard deviation of 1.940, illustrating a considerable breadth in risk sensitivities. The average ESG Performance Score (ESGPS) stands at 0.480, with a standard deviation of 0.620, showcasing variability in ESG practices. Cash flow averages 175.300, with a standard deviation of 26.040. The average cost of debt (K_d) is 1.789, with a notable range, emphasizing the diversity in borrowing costs. These statistics highlight the substantial variation in both financial and ESG profiles among the firms studied.

Moving to the correlation matrix in Table 4, several significant relationships among the study's variables emerge. A strong positive correlation is observed between RoCE and Beta, suggesting that companies with higher ROCE are more sensitive to SR. In contrast, Cash flow (CF) exhibits significant negative correlations with ESG performance scores (ESGPSs), indicating that firms with higher ESG performance may have lower cash flows and liquidity. These findings illustrate the intricate relationships between financial metrics, ESG performance, and SR sensitivity, guiding further investigation in the study. Notably, no pairwise correlations exceed 0.691, suggesting that multicollinearity is not a significant concern.

Table 3. Descriptive statistics.

Variable	Obs.	Avg.	S.D.	Min.	Max.
β	2568	0.6300	1.9400	−8.4900	7.4900
ESGPS	2568	0.4800	0.6200	0.2300	0.8700
FS	2568	5.1039	2.9730	0.5681	8.4763
CF	2568	175.3000	26.0400	−0.5900	418.2000
LEV	2568	1.5800	0.2800	0.0200	14.3000
RoA	2568	6.4900	3.0800	−0.3900	27.3900
CO	2568	64.1030	21.5900	0.5800	2940.3100
RoCE	2568	16.9326	5.4019	−0.0481	23.4910
RP	2568	13.2900	33.3900	−58.2000	308.1000
Firm Age	428	44.04	24.85	4	122
Firm Size	428	4.3900	2.3000	0.9200	6.4900
Cost of Debt	428	1.789	0.713	−1.293	4.981

Table 4. Correlation matrix.

Variables	Beta	ESGPS	FS	CF	LEV	RoA	CO	RoCE	RP
Beta	1.000								
ESGPS	0.350	1.000							
FS	0.038	0.245	1.000						
CF	0.077	−0.451	0.374	1.000					
LEV	0.345	0.591	0.118	−0.540	1.000				
RoA	0.451	0.576	0.204	0.103	−0.395	1.000			
CO	0.487	0.054	0.054	0.491	−0.053	0.591	1.000		
RoCE	0.581	0.228	0.150	0.223	0.194	0.010	0.681	1.000	
RP	0.374	0.094	−0.050	0.491	0.019	0.108	0.591	−0.673	1.000

In order to mitigate the presence of multicollinearity, the variance inflation factor (VIF) was computed as a diagnostic measure, as shown in Table 5. Since the VIF values do not exceed 10, we can infer that there are no substantial multicollinearity concerns, thereby validating the reliability of the regression analysis.

Table 5. Variance inflation factor.

Variables	VIF	1/VIF
ESGPS	2.401	0.416
FS	1.044	0.958
CF	1.778	0.562
LEV	3.108	0.226
RoA	2.349	0.426
CO	1.159	0.863
RoCE	1.690	0.592
RP	2.502	0.400
Mean VIF	2.264	

In this study, the Granger Causality test was conducted to examine whether ESG performance scores (ESGPSs) can predict systemic risk sensitivity (SR Sensitivity). The test results, as shown in Table 6, indicate a significant causal relationship, with *p*-values suggesting that the ESGPSs can indeed predict SR Sensitivity. These findings suggest that improvements in ESG practices may have an immediate effect on reducing a firm's risk sensitivity, highlighting the importance of ESG factors in managing systemic risk.

Table 6. Granger Causality test.

Hypothesis	F-Statistic	p-Value	Significance
ESGPS does not Granger-cause SR Sensitivity	4.75	0.013	***

Note: Significance level: *** indicates $p < 0.01$.

4.2. ESG-SR Sensitivity Nexus

This study employs fixed effect panel regression to test the hypotheses, emphasizing the importance of using a robust model to address heterogeneity and correlation issues, as recommended by Malik and Kashiramka (2024). To evaluate Hypothesis H1, a fundamental regression model is established to quantify the firm's exposure to systemic risks:

$$\beta = \text{CONST} + \beta_{1i}\text{ESGPS}_{it} + \beta_{2i}\text{FS}_{it} + \beta_{3i}\text{CF}_{it} + \beta_{4i}\text{LEV}_{it} + \beta_{5i}\text{RoA}_{it} + \beta_{6i}\text{CO}_{it} + \beta_{7i}\text{RP}_{it} + \beta_{8i}\text{RoCE}_{it} + \lambda_{it} + \mu_{it} \quad (3)$$

In this model, β quantifies the firm's exposure to systemic risks. λ_{it} represents year and industry effects. Each company is assigned a rating by Thomson Reuters, as detailed in Table 1. The aim of this regression analysis is to quantify how each of these factors contributes to the SR sensitivity of the firms in our sample. The ESG performance score is particularly scrutinized to understand its impact, controlling for other financial variables. Each firm is given a corresponding rating by Thomson Reuters, reflecting its ESG performance and other financial indicators, facilitating a comprehensive analysis of how these variables interact to influence SR sensitivity. The focus is on analyzing the value and statistical significance of the coefficient β_1 , while μ_{it} denotes an error term. The results of this regression analysis are presented in Table 7.

Table 7. Regression analysis result—1.

Variables		Systemic Risk (β)
ESG Performance Score	ESGPS	−0.183 *** (−1.18)
Firm Size	FS	−0.014 *** (−12.31)
Cash Flow	CF	−0.00122 (−0.85)
Leverage	LEV	−0.004 (−3.40)
Return on Assets	RoA	−0.916 *** (−4.39)
Capital Output	CO	0.0430 (0.75)
Relative to Issue Price	RP	−0.00058 * (−0.26)
Return on Capital Employed	RoCE	−0.154 ** (−2.25)
CONST		3.481 *** (22.72)
Year Effect		YES
Industry Effect		YES
Obs.		2568
R-squared		0.538
F-test for Fixed Effects (p -value)		13.42 (0.0098)
Hausman Test (p -value)		16.29 (0.0148)
Test for Cross-Sectional Dependence (p -value)		1.98 (0.12)
Wald Test for Heteroskedasticity (p -value)		29.34 (0.83)
BP LM Test (p -value)		37.560 (0.108)

Note: t-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

Table 7 provides valuable insights into the factors influencing SR within enterprises. Notably, a firm's ESG score, FS, RP, RoA, and RoCE all exhibit significant negative effects on SR. Conversely, there is no statistically significant association between SR and LEV, CF, or CO. Although CO shows a positive correlation with ESG ratings, this relationship lacks statistical significance.

A firm's ESG rating exerts a profound influence on its susceptibility to SR, with empirical evidence substantiating that firms possessing superior ESG ratings exhibit diminished sensitivity to SR. This observation corroborates Hypothesis 1 and highlights the pivotal role of robust ESG strategies in mitigating exposure to systematic risks. Additionally, the analysis reveals that a larger firm size is significantly inversely related to SR, as expansive firms typically command a greater market influence, attract a broader spectrum of investors, and uphold higher transparency standards, thereby collectively attenuating market risk.

Our findings align with similar studies conducted globally, highlighting the universal importance of ESG considerations in risk management and investment decision making. Research by Sassen et al. (2016), Saci et al. (2024), (Cerqueti et al. 2021), and Aevoae et al. (2023) reinforces the notion that strong ESG performance enhances companies' resilience to systemic shocks and fosters sustainable growth. Additionally, stock price volatility is significantly negatively associated with SR. This finding supports Novy-Marx's (2011) assertion that operating leverage impacts cross-sectional returns. A robust return on assets shows a strong inverse relationship with SR, suggesting that greater profitability significantly mitigates a company's susceptibility to SR. This concept is further supported by Smith's (1776) economies of scale theory, which posits that larger firms enjoy lower per-unit fixed costs, enhancing profit margins and reducing exposure to market volatility.

Interestingly, the study finds no significant relationships between SR and LEV, CF, and CO. The lack of a significant relationship with leverage may stem from the diverse debt structures of firms, resulting in inconsistent risk profiles. This variability likely obscures any clear connection between leverage and SR. Additionally, the small sample size may limit the statistical power of analysis, hindering the detection of significant relationships (Shapiro and Wilk 1965). Cash flow's lack of a significant relationship with SR could be attributed to its inherent variability and unpredictability, influenced by external factors such as economic cycles and market conditions, which can diminish its effectiveness in predicting SR. Moreover, incomplete or limited data might not fully capture the range of cash flow characteristics, affecting the analysis' power (Wooldridge 2013). The effects of capital output on risk may be long-term, making them less detectable in short-term analyses and thus reducing the likelihood of finding significant relationships with SR in this study (Merton 1973). Considering these factors, the study's findings on the insignificance of these variables underscore the importance of sample size, data quality, and the inherent complexity of each variable's impact on SR.

Overall, the results affirm that a firm's ESG performance and size are critical determinants of its sensitivity to SR, while other factors such as cash flow, capital output, and financial leverage do not show a significant impact within this study's framework. The observed relationship between SR sensitivity and ESG performance highlights the evolving dynamics of the Indian financial markets. Companies with robust ESG frameworks demonstrate a proactive approach to risk management, mitigating the potential financial risks associated with ESG factors. This aligns with global trends in sustainable investing, where ESG considerations play a pivotal role in investment decision making.

4.3. Firm Size, ESG, and SR Sensitivity Dynamics

Our empirical analysis indicates that the size of a company plays a significant role in influencing SR. To delve deeper, we formulated Hypothesis 2, which suggests that for large firms, a higher ESG rating may correlate with increased SR. This relationship is thought to be driven by the strategic allocation of ESG expenditures, which can lead to a higher operating leverage.

In this study, firms are categorized into three distinct groups based on their firm value: small firms (DUM_Q1), mid-sized firms (DUM_Q2), and large firms (DUM_Q3). This categorization allows for a more nuanced analysis of how ESG performance scores (ESGPSs) influence systemic risk (SR) across firms of varying sizes.

The division into three categories is driven by the need to understand whether the size of a firm moderates the relationship between ESG performance and systemic risk. Firm size is a critical factor that can influence how a company responds to external risks, including those related to ESG factors. Smaller firms may lack the resources, risk management capabilities, and diversification that larger firms possess, making them potentially more vulnerable to systemic risks. Mid-sized firms, while more resilient than small firms, may still not have the extensive risk mitigation strategies available to large firms. Therefore, analyzing the impact of the ESGPS across these different firm sizes helps in identifying tailored strategies for managing systemic risks.

Firm size was measured using the logarithm of total assets, consistent with previous studies (Saci et al. 2024; Dang et al. 2018; Ibhagui and Olokoyo 2018). Firms were grouped into quartiles based on their firm value (log of total assets), resulting in three groups:

1. DUM_Q1 (Small Firms): Represents firms in the lowest quartile (Q1) with firm value ≤ 2.840 , representing approximately the bottom 25% of firms. Takes the value 1 if the firm's log of total assets is in the first quartile (Q1) and 0 otherwise.
2. DUM_Q2 (Mid-sized Firms): Represents firms in the second quartile (Q2), with firm values between 2.840 and 5.940, representing the middle 50% of firms. Firms with a firm value between 2.840 and 5.940. Takes the value 1 if the firm's log of total assets is between the first quartile (Q1) and the third quartile (Q3) and 0 otherwise.
3. DUM_Q3 (Large Firms): Represents firms in the third quartile (Q3), with firm value > 5.940 , representing the top 25% of firms. Firms with a firm value > 5.940 . Takes the value 1 if the firm's log of total assets is in the third quartile (Q3) and 0 otherwise.

Out of 428 companies in our sample, 112 firms belonged to Q1, 198 to Q2, and 118 to Q3.

We employed a fixed effects panel regression for the analysis. The equations for each model are as follows:

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 DUM\_Q1_{it} + \beta_3 (ESGPS \times DUM\_Q1)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (4)$$

Equation (4) is for the small firms, where SR_{it} is the systemic risk for the firm i at time t , α is the firm fixed effect, $ESGPS_{it}$ is the ESG performance score, and DUM_Q1_{it} is the dummy variable for small firms. The interaction term between the ESGPS and small firm dummy is $ESGPS \times DUM\_Q1$. X_{it} represents control variables, λ_{it} represents year and industry effects, and ε_{it} is the error term.

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 DUM\_Q2_{it} + \beta_3 (ESGPS \times DUM\_Q2)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (5)$$

Equation (5) is for the mid-size firms. Where DUM_Q2_{it} represents the mid-sized firms.

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 DUM\_Q3_{it} + \beta_3 (ESGPS \times DUM\_Q3)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (6)$$

Equation (6) is for the large firms, where DUM_Q3_{it} represents the large firms.

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 FV\_C_{it} + \beta_3 (ESGPS \times FV\_C)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (7)$$

Equation (7) takes all firms; here, we consider the firm value as a continuous variable and not the dummy variable. This will provide us additional insights. Here, FV_C_{it} represents the continuous measure of firm value.

The results of this regression analysis are presented in Table 8.

The first model (Model I) focuses on small firms, where firm value is represented by DUM_Q1 . The coefficient for ESGPS is positive and significant at the 1% level ($\beta = 0.07458$, $t = 3.19$), suggesting that a higher ESGPS is associated with an increase in SR for small firms. The interaction term $ESGPS \times DUM\_Q1$ also shows a positive and significant relationship

($\beta = 0.03567$, $t = 3.45$), indicating that the impact of ESGPS on SR is particularly strong for small firms. This supports the notion that small firms are more sensitive to ESG factors, likely due to their relatively limited resources and higher vulnerability to external shocks.

Table 8. Regression results for firm size.

Variables		Model (I): Small Firms	Model (II): Mid-Sized Firms	Model (III): Large Firms	Model (IV): All Firms
		Systemic Risk (β)	Systemic Risk (β)	Systemic Risk (β)	Systemic Risk (β)
ESG Performance Score	ESGPS	0.07458 *** (3.19)	0.05137 ** (2.46)	0.01967 (1.48)	0.04026 *** (3.11)
Firm Value	DUM_Q1	0.10234 *** (3.02)			
ESGPS $\times$ Firm Value	ESGPS $\times$ DUM_Q1	0.03567 *** (3.45)			
Firm Value	DUM_Q2		0.06345 ** (2.14)		
ESGPS $\times$ Firm Value	ESGPS $\times$ DUM_Q2		0.02241 ** (2.19)		
Firm Value	DUM_Q2			0.03018 * (1.70)	
ESGPS $\times$ Firm Value	ESGPS $\times$ DUM_Q2			0.01012 (1.12)	
Firm Value (Continuous)	FV_C				−0.025 ** (2.20)
ESGPS $\times$ Firm Value (Continuous)	ESGPS $\times$ FV_C				−0.010 * (1.85)
Cash Flow	CF	−0.0749 (−0.84)	−0.017 (0.015)	−0.003 (0.002)	−0.002 (0.003)
Leverage	LEV	−0.00419 (−2.18)	−0.01 (0.048)	−0.002 (0.003)	−0.003 (0.001)
Return on Assets	RoA	−0.314 *** (0.070)	−0.180 *** (0.081)	−0.150 ** (0.001)	−0.160 *** (0.001)
Capital Output	CO	0.291 (0.301)	0.007 (0.017)	0.009 (0.010)	0.090 (0.037)
Relative to Issue Price	RP	0.08945 * (0.054)	0.07023 * (0.014)	0.06012 * (0.192)	0.06489 * (0.168)
Return on Capital Employed	RoCE	0.220 * (3.60)	0.200 * (3.40)	0.170 * (2.80)	0.180 * (3.50)
	CONST	6.385 *** (1.284)	1.841 *** (0.071)	5.800 *** (0.068)	6.200 *** (2.081)
	Year Effect	YES	YES	YES	YES
	Industry Effect	YES	YES	YES	YES
	Obs.	112	198	118	428
	R-squared	0.551	0.563	0.608	0.593
F-test for Fixed Effects (p -value)		5.12 (0.003)	4.89 (0.002)	4.43 (0.002)	6.02 (0.0079)
Hausman Test (p -value)		18.09 (0.0014)	15.72 (0.0023)	17.23 (0.0160)	18.40 (0.0103)
Test for Cross-Sectional Dependence (p -value)		2.30 (0.25)	2.97 (0.45)	2.68 (0.33)	3.40 (0.96)
Wald Test for Heteroskedasticity (p -value)		22.36 (0.62)	18.93 (0.43)	17.15 (0.18)	20.95 (0.35)
BP LM Test (p -value)		1.95 (0.162)	0.21 (0.80)	8.25 (0.098)	0.30 (0.71)

Note: t -statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

In the second model (Model II), mid-sized firms are analyzed with firm value represented by DUM_Q2. Similar to the small firms, the ESGPS positively and significantly affects SR ($\beta = 0.05137$, $t = 2.46$), though the magnitude of the effect is somewhat lower than for small firms. The interaction term ESGPS $\times$ DUM_Q2 is also positive and significant ($\beta = 0.02241$, $t = 2.19$), but again, the effect size is smaller compared to small firms. This finding suggests that mid-sized firms, while still sensitive to ESGPS, experience a less pronounced impact compared to small firms.

Model III examines large firms, with firm value represented by DUM_Q3. In this case, the ESGPS coefficient is positive but not statistically significant ($\beta = 0.01967$, $t = 1.48$), indicating that the relationship between ESGPS and SR is weaker for large firms. The interaction term ESGPS * DUM_Q3 is also not significant ($\beta = 0.01012$, $t = 1.12$). These results suggest that large firms are less affected by changes in ESGPS when it comes to SR, potentially due to their more diversified operations, better risk management practices, and greater access to resources.

In the final model (Model IV), firm value is treated as a continuous variable rather than as a set of dummy variables. Here, the ESGPS coefficient remains positive and significant ($\beta = 0.04026$, $t = 3.11$) but the interaction term ESGPS * FV_C is negative and significant ($\beta = -0.002$, $t = -2.00$). This negative interaction suggests that as firm size increases (when measured continuously), the impact of ESGPS on SR diminishes. The negative and significant coefficient for firm value (FV_C) itself ($\beta = -0.005$, $t = -2.20$) further reinforces this finding, indicating that larger firms are less sensitive to the ESGPS in relation to their systemic risk.

The results provide strong support for Hypothesis 2, which posits that ESG ratings have a less pronounced impact on the sensitivity of SR for large firms compared to mid-sized and small firms. The analysis reveals a clear pattern: small firms exhibit the highest sensitivity to ESGPS, with the impact gradually weakening as firm size increases. This pattern is consistent across both the dummy variable models (Models I–III) and the continuous firm value model (Model IV).

For small firms, the significant positive relationship between ESGPS and SR suggests that these firms, due to their smaller scale and potentially fewer resources, are more vulnerable to fluctuations in ESG performance. This heightened sensitivity could be attributed to the fact that smaller firms may lack the robust risk management frameworks that larger firms possess, making them more susceptible to ESG-related risks.

Mid-sized firms also show a significant relationship, though the effect is weaker than that for small firms. This indicates that while mid-sized firms are still affected by the ESGPS, their greater resources and more developed risk management practices compared to small firms may provide some buffer against ESG-related risks.

For large firms, the relationship between ESGPS and SR is weak and statistically non-significant, suggesting that these firms are less affected by changes in ESG performance. The insignificant interaction terms for large firms (DUM_Q3 and ESGPS * DUM_Q3) further support the idea that large firms' systemic risk is less sensitive to ESG performance. This could be due to large firms' ability to better manage ESG risks through diversification, access to capital, and more sophisticated risk management systems.

The continuous variable model (Model IV) provides additional confirmation of these findings. The negative interaction between ESGPS and firm value (when measured continuously) indicates that as firms grow larger, the impact of the ESGPS on SR becomes less significant. This aligns with previous results and further validates the hypothesis.

Three potential mechanisms may explain this relationship:

- (1) Large firms tend to allocate a larger proportion of their expenditure to ESG strategies, increasing their operating leverage. This can lead to higher credit risk, slower profit growth, and increased financing costs, thereby diluting the positive effects of ESG ratings on profitability.
- (2) ESG ratings positively influence FP, enticing cost-intensive and highly leveraged firms to market, which in turn elevates SR.
- (3) There is a phenomenon of diminishing marginal benefits from ESG ratings; as companies achieve higher ratings, the incremental benefits tend to decrease.

4.4. Firm Age, ESG, and SR Sensitivity Dynamics

To provide more targeted recommendations to companies, we introduce Hypothesis 3, which posits that older firms, with their established operational frameworks and market positions, may display different patterns for how ESG practices influence their risk profiles compared to younger firms.

To test Hypothesis 3, we developed fixed effect panel regression models to examine the ESG-SR sensitivity nexus across firms of varying ages. The models are specified as follows:

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 FA\_C_{it} + \beta_3 (ESGPS \times FA\_C)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (8)$$

Equation (8) is for the model (I), where we considered the firm age as a continuous variable and not the dummy variable. Here, FA_C_{it} represents the continuous measure of firm age.

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 DUM\_FA_{it} + \beta_3 (ESGPS \times DUM\_FA)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (9)$$

In Equation (9), we consider firm age as a dummy variable; DUM_FA_{it} represents the dummy measure of firm age. For this purpose, we categorized companies in our sample based on their age, with the average firm age being 44 years. Companies were divided into two groups: those older than the mean (high-age), consisting of 188 companies, and those younger than the mean (low-age), comprising 240 companies. This classification was represented by the dummy variable DUM_FA, with high firm age coded as 1 and low firm age as 0. Model (II) of Table 9 presents the regression results for this classification.

Table 9. Regression results for firm age.

Variables		Model (I)	Model (II)
		Systemic Risk (β)	Systemic Risk (β)
ESG Performance Score	ESGPS	0.019 (0.006)	0.004 (0.004)
Firm Age (Continuous)	FA_C	0.007 ** (2.33)	
ESGPS × Firm Age (Continuous)	ESGPS × FA_C	−0.002 ** (0.001)	
Firm Age (DUMMY)	DUM_FA		2.180 *** (19.96)
ESGPS × Firm Age (DUMMY)	ESGPS × DUM_FA		−0.006 ** (0.002)
Firm Size	FS	−0.067 * (0.038)	−0.073 * (0.021)
Cash Flow	CF	−0.021 (0.032)	−0.023 (0.035)
Leverage	LEV	−0.04 (0.060)	−0.02 (0.040)
Return on Assets	RoA	−0.118 *** (0.073)	−0.218 *** (0.068)
Capital Output	CO	0.006 (0.015)	0.008 (0.016)
Relative to Issue Price	RP	0.032 * (0.012)	0.029 * (0.013)
Return on Capital Employed	RoCE	0.136 * (0.040)	0.128 * (0.038)
	CONST	1.693 *** (0.075)	1.758 *** (0.083)
	Year Effect	YES	YES
	Industry Effect	YES	YES
	Obs.	428	428
	R-squared	0.658	0.672
F-test for Fixed Effects (p-value)		4.98 (0.009)	6.01 (0.007)
Hausman Test (p-value)		16.38 (0.0019)	18.22 (0.0023)
Test for Cross-Sectional Dependence (p-value)		3.77 (0.48)	5.58 (0.75)
Wald Test for Heteroskedasticity (p-value)		19.64 (0.70)	20.83 (0.63)
BP LM Test (p-value)		7.57 (0.271)	8.79 (0.318)

Note: t-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

For model (I), the coefficient for firm age, when treated as a continuous variable, is positive and statistically significant. This finding implies that older firms are more likely to experience higher systemic risk. This could be due to various factors associated with aging firms, such as increased operational complexities, legacy systems, and greater exposure to market volatility. The interaction between ESG performance scores and firm age (continuous) is negative and statistically significant. This negative interaction indicates that the impact of ESG performance on systemic risk decreases as firms age. In other words, for older firms, the mitigating effect of high ESG performance on systemic risk is less pronounced compared to younger firms.

For model (II), the analysis of firm age and its interaction with ESG ratings provides significant insights into SR sensitivity. The positive and statistically significant coefficient associated with the firm age dummy variable denotes that older firms have a higher baseline SR compared to younger firms. Furthermore, a negative as well as statistically significant interaction term between firm age and ESG performance scores suggests that the impact of ESG ratings on SR is less pronounced for older firms.

The results from both Model (I) and Model (II) provide strong support for the hypothesis (H3), which asserts that older firms are less sensitive to ESG ratings concerning their SR. This implies that the established practices and financial stability commonly associated with older firms may diminish the influence of ESG factors on their overall risk profile, unlike younger firms, which show greater sensitivity to ESG performance. Therefore, risk management strategies for older firms may need to address factors beyond ESG ratings to effectively mitigate SR.

Older firms often benefit from established market positions, long-term stakeholder relationships, and accumulated experience in managing various risks. These elements can provide a stabilizing effect, making older firms less susceptible to SR and less dependent on ESG performance for risk mitigation (Barney 1991). Additionally, the organizational inertia and resistance to change typically seen in older firms may hinder the full integration and effectiveness of ESG initiatives, further reducing their impact on SR.

4.5. Cost of Debt, ESG, and SR Sensitivity Dynamics

Given the critical role of financial conditions in shaping risk profiles, we propose Hypothesis 4, which suggests that firms with lower borrowing costs may enjoy more robust financial conditions, potentially reducing their sensitivity of SR to ESG factors. Conversely, firms with higher borrowing costs might feel more significant impacts from ESG ratings due to the added financial pressure.

To test Hypothesis 4, we developed fixed effect panel regression models to examine ESG-SR sensitivity nexus across firms of K_d . The models are specified as follows:

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 CoD\_C_{it} + \beta_3 (ESGPS \times CoD\_C)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (10)$$

Equation 10 is for model (I), where we considered the K_d as a continuous variable and not a dummy variable. Here, CoD_C_{it} represents the continuous measure of K_d .

$$SR_{it} = \alpha_i + \beta_1 ESGPS_{it} + \beta_2 DUM\_CoD_{it} + \beta_3 (ESGPS \times DUM\_CoD)_{it} + \gamma X_{it} + \lambda_{it} + \varepsilon_{it} \quad (11)$$

For Equation (11), we considered K_d as a dummy variable; DUM_CoD represents the dummy measure of K_d . This equation represents model (II). For this model, we classified the companies in our sample based on their K_d , with the mean K_d being 1.789%. Companies were divided into two groups: those with a cost of debt above the mean (high-value), totaling 195 companies, and those below the mean (low-value), comprising 233 companies. This classification was denoted by the dummy variable DUM_CoD , with a high cost of debt coded as 1 and a low cost of debt as 0. Model (II) of Table 10 presents the regression results for this classification.

Table 10. Regression results for cost of debt.

Variables		Model (I)	Model (II)
		Systemic Risk (β)	Systemic Risk (β)
ESG Performance Score	ESGPS	−0.020 *** (0.006)	−0.024 *** (0.005)
Cost of Debt (Continuous)	CoD_C	0.031 *** (0.008)	
ESGPS $\times$ Cost of Debt (Continuous)	ESGPS $\times$ CoD_C	−0.110 *** (0.030)	
Cost of Debt (DUMMY)	DUM_CoD		0.034 *** (0.009)
ESGPS $\times$ Cost of Debt (DUMMY)	ESGPS $\times$ DUM_CoD		−0.121 *** (0.031)
Firm Size	FS	−0.008 ** (0.003)	−0.003 *** (0.001)
Cash Flow	CF	−0.002 (0.001)	−0.003 (0.002)
Leverage	LEV	−0.003 (0.002)	−0.002 (0.003)
Return on Assets	RoA	−0.001 * (0.001)	−0.001 * (0.001)
Capital Output	CO	0.007 (0.008)	0.009 (0.010)
Relative to Issue Price	RP	0.330 * (0.190)	0.349 * (0.192)
Return on Capital Employed	RoCE	0.012 * (0.007)	0.010 * (0.006)
	CONST	1.698 *** (0.080)	1.758 *** (0.083)
	Year Effect	YES	YES
	Industry Effect	YES	YES
	Obs.	428	428
	R-squared	0.591	0.583
F-test for Fixed Effects (<i>p</i> -value)		7.58 (0.018)	6.31 (0.0273)
Hausman Test (<i>p</i> -value)		14.59 (0.0023)	16.38 (0.0018)
Test for Cross-Sectional Dependence (<i>p</i> -value)		2.77 (0.25)	2.16 (0.31)
Wald Test for Heteroskedasticity (<i>p</i> -value)		25.51 (0.81)	23.38 (0.41)
BP LM Test (<i>p</i> -value)		8.69 (0.312)	9.15 (0.270)

Note: *t*-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

Model (I) serves as the baseline analysis, incorporating ESG performance scores, K_d as a continuous variable, and their interaction effect, along with several control variables. The coefficient for ESGPS is negative and statistically significant at the 1% level ($\beta = -0.020$, $p < 0.01$), suggesting that higher ESG performance is associated with lower systemic risk. This finding aligns with the hypothesis that firms with better ESG performance are perceived as less risky by investors, possibly due to better management practices and reduced exposure to environmental and social risks. The coefficient for the K_d as a continuous variable is positive and significant at the 1% level ($\beta = 0.031$, $p < 0.01$). This indicates that firms with higher costs of debt tend to have higher systemic risk, which could be due to the financial burden and the potential for distress associated with higher borrowing costs. The interaction term between the ESGPS and CoD_C is negative and significant at the 1% level ($\beta = -0.110$, $p < 0.01$). This finding supports the hypothesis (H4)

that the negative impact of ESG performance on systemic risk is more pronounced for firms with a lower K_d . Essentially, ESG practices may serve as a buffer against risk, especially in firms with favorable borrowing conditions.

Model (II) extends the baseline analysis by incorporating K_d as a dummy variable, distinguishing between firms with high and low costs of debt, along with their interaction with ESG performance scores. This model tests the robustness of the findings from Model (I) and examines whether the observed relationships hold when considering the K_d in a categorical form. Similar to Model (I), the coefficient for ESGPS remains negative and statistically significant at the 1% level ($\beta = -0.024, p < 0.01$). This consistency reinforces the finding that a higher ESGPS is associated with a lower SR. The coefficient for the K_d dummy variable is positive and significant at the 1% level ($\beta = 0.034, p < 0.01$), indicating that firms with high costs of debt are more exposed to systemic risk. This finding is consistent with the continuous measure of K_d used in Model (I). The interaction term between ESGPS and DUM_CoD is negative and significant at the 1% level ($\beta = -0.121, p < 0.01$), mirroring the results from Model (I). This further supports the hypothesis (H4) that ESG practices mitigate systemic risk more effectively in firms with a lower K_d .

One potential reason for this interaction could be that firms with lower costs of debt are generally perceived as less risky by creditors, allowing them more financial flexibility to invest in sustainable practices. These firms may have better access to capital, enabling them to allocate resources towards initiatives that enhance their ESG performance, thereby further mitigating their exposure to systemic risk.

Additionally, the lower K_d may reflect a firm's strong financial health, which could complement the benefits of high ESG performance. Financially stable firms with robust ESG practices might be better equipped to withstand external shocks and uncertainties, reducing their overall systemic risk. This synergistic relationship highlights the importance of both sound financial management and strong ESG performance in minimizing the systemic risk for firms.

Overall, the results suggest that integrating ESG considerations into corporate strategy can be particularly beneficial for firms that maintain low borrowing costs, as it amplifies their resilience against broader market risks.

4.6. Robustness Test

To substantiate our results, we conducted a comprehensive suite of robustness tests, following the methodology proposed by Zhao and Yue (2014). Initially, we revised our model by substituting the original control variables with alternative ones. Specifically, we adopted Gao's (2016) approach, replacing the fluctuation in relative issue price with the ratio of market value to face value (MFVR). This substitution aims to ensure that our results are not sensitive to the original control variables.

We assessed the robustness of the model by examining the stability of the coefficients and their significance levels. A model is considered robust if the coefficients and their significance levels remain consistent across different specifications. Additionally, we introduced new control variables to further validate the model's robustness. These factors encompass board independence (BI), which is assessed by the proportion of non-executive directors compared to the total number of directors; the price-to-earnings ratio (P/E), calculated by dividing the market price per share by earnings per share (EPS); and the quick ratio, determined by subtracting the inventory from current assets and dividing the result by current liabilities. The market value to face value ratio (MFVR) is calculated by dividing the market value of a security by its face value. All these variables were sourced from the CMIE ProwessIQ Database.

To further test the robustness of our findings, we replaced the ESG ratings from Thompson Reuters with the ESG risk ratings from Morningstar's Sustainalytics (ESGRRS). These ratings offer a comprehensive assessment of a firm's exposure to and management of industry-specific ESG risks and were obtained from the Global Access—Sustainability Research Database.

Lastly, we utilized the standard deviation of the operating profit margin (Std (ROA)) in place of the beta coefficient to verify the robustness of our model, as outlined by Zhao and Yue (2014). If the signs and significance levels of the explanatory variable coefficients remain largely unchanged, it supports the robustness and reliability of our model.

The updated model is specified as follows:

$$\text{Std. (RoA)}_{it} = \text{CONST} + \beta_{1i}\text{ESGRPS}_{it} + \beta_{2i}\text{FS}_{it} + \beta_{3i}\text{CF}_{it} + \beta_{4i}\text{CO}_{it} + \beta_{5i}\text{MFVR}_{it} + \beta_{6i}\text{QR}_{it} + \beta_{7i}\text{BI}_{it} + \beta_{8i}\text{PE}_{it} + \lambda_{it} + \mu_{it} \quad (12)$$

The empirical outcomes of these robustness tests, detailed in Table 11, corroborate our previous findings and align with the research conducted by Klarman (1991). They demonstrate that a firm's ESG performance continues to significantly impact its SR, reinforcing the strength and reliability of our conclusions.

Table 11. Robustness test—I.

Variables		Std. (RoA)
ESG Risk Rating Score	ESGRRS	−0.0118 * (−0.93)
Firm Size	FS	−0.00186 ** (−1.93)
Cash Flow	CF	0.0641 *** (−3.48)
Capital Output	CO	−0.0753 ** (−1.84)
Market Value to Face Value Ratio	MFVR	−0.00481 ** (−0.24)
Quick Ratio	QR	−1.802 *** (0.488)
Board Independence	BI	−0.00081 (0.003)
Price-to-Earnings Ratio	PE	−2.154 *** (0.157)
CONST		0.201 *** (4.48)
Year Effect		YES
Industry Effect		YES
Obs.		2568
R-squared		0.461
F-test for Fixed Effects (<i>p</i> -value)		10.08 (0.007)
Hausman Test (<i>p</i> -value)		14.48 (0.013)
Test for Cross-Sectional Dependence (<i>p</i> -value)		4.05 (0.30)
Wald Test for Heteroskedasticity (<i>p</i> -value)		34.50 (0.93)
BP LM Test (<i>p</i> -value)		68.491 (0.560)

Note: t-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

To address potential endogeneity between ESG performance and systemic risk (SR), we apply an instrumental variable (IV) regression approach. Drawing on the methodologies of Tang et al. (2024), Gao et al. (2023), Yu and Xiao (2022), and Benlemlih and Bitar (2018), we utilize the industry-year average of the ESG composite score (ESG_ind) as an instrumental variable. We then conduct a two-stage regression analysis to estimate the IV model. The results are presented in Table 12, providing further insight into the robustness of the previous findings.

Table 12. Robustness test- II.

Variables	1st Stage Coefficient (ESGPS)	2nd Stage Coefficient [Systemic Risk (β)]
Industry-Year Average ESG Score (ESG_ind)	0.145 *** (3.45)	-
ESG Performance Score (ESGPS)	-	-0.172 *** (-3.11)
Firm Size (FS)	0.051 ** (2.05)	-0.013 *** (-4.27)
Cash Flow (CF)	0.009 (0.62)	-0.00108 (-0.72)
Leverage (LEV)	-0.026 ** (-2.10)	-0.0039 *** (-3.25)
Return on Assets (RoA)	0.073 ** (2.28)	-0.892 *** (-4.01)
Capital Output (CO)	0.014 (0.71)	0.046 (0.83)
Relative to Issue Price (RP)	0.005 (1.15)	0.0010123
Return on Capital Employed (RoCE)	0.032 * (1.89)	-0.143 ** (-2.32)
Constant	0.185 *** (4.12)	3.512 *** (23.01)
R-squared	0.327	0.527
Observations	2568	2568
F-test for Weak Instrument		16.09 ***

Note: t-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

For the first stage analysis, the industry-year average of ESG composite score (ESG_ind) significantly impacts the ESGPS, with a coefficient of 0.145 (T-value = 3.45). This confirms that ESG_ind is a relevant instrument for ESGPS. Among the control variables, FS, LEV, RoA, and RoCE significantly impact the ESGPS, indicating that these factors play a role in determining the ESG ratings of firms.

For second stage analysis, the relationship between ESGPS and SR remains negative and significant (coefficient = -0.172, T-value = -3.11) after addressing potential endogeneity using the 2SLS approach. This supports the original hypothesis (H1) that higher ESG ratings reduce a firm's sensitivity to SR. Control variables such as FS, LEV, RoA, and RoCE continue to show significant impacts on SR, reinforcing the robustness of the results.

The robustness test using the IV regression method confirms that the original findings are not driven by endogeneity. The higher ESG ratings indeed reduce a firm's sensitivity to systemic risk, even after controlling for potential endogeneity. The instrumental variable approach validates the robustness of the results, strengthening the overall conclusions of the study. The control variables' significant effects in the first stage further affirm their importance in determining ESG performance.

Further, we use a lagged regression approach to avoid the bias from endogeneity. Firstly, we regress independent variables by using one-, three-, and five-period lagged ESG variables to test the impact of changes in ESGPS on a SR. Table 13 shows the results for the lagged regression.

The one-, three-, and five-period lagged ESGPS have a consistent negative and significant impact on SR across all lag lengths. Specifically, the coefficients for lagged ESGPS are -0.174 (1-period lag), -0.167 (3-period lag), and -0.159 (5-period lag), with corresponding T-values of -3.18, -2.95, and -2.78, respectively. These results align with the original regression results, further confirming that higher ESG ratings reduce a firm's sensitivity to SR, even when considering lagged effects. The impact of control variables such as FS, LEV, RoA, and RoCE remains significant across all lagged models, similar to the original regression results. This consistency indicates that these variables continue to play a crucial role in influencing systemic risk, regardless of the lag in ESG performance scores. The R-squared values for the lagged models are 0.532 (1-period lag), 0.529 (3-period lag), and 0.526 (5-period lag), demonstrating a slight decrease in the explanatory power as the lag length increases. However, the models still maintain strong overall explanatory power, indicating that the inclusion of lagged ESG variables does not significantly diminish the model's ability to explain SR.

Table 13. Robustness test—III.

Variables	Model (I)	Model (II)	Model (III)
	Systemic Risk (β)	Systemic Risk (β)	Systemic Risk (β)
ESGPS 1-Period Lagged	−0.174 *** (−3.18)		
ESGPS 3-Period Lagged		−0.167 *** (−2.95)	
ESGPS 5-Period Lagged			−0.159 *** (−2.78)
Firm Size (FS)	−0.012 *** (−4.21)	−0.013 *** (−4.13)	−0.014 *** (−4.09)
Cash Flow (CF)	−0.00105 (−0.70)	−0.00108 (−0.73)	−0.00111 (−0.74)
Leverage (LEV)	−0.0038 *** (−3.27)	−0.0040 *** (−3.33)	−0.0041 *** (−3.30)
Return on Assets (RoA)	−0.903 *** (−4.03)	−0.891 *** (−4.02)	−0.884 *** (−3.97)
Capital Output (CO)	0.045 (0.81)	0.043 (0.79)	0.041 (0.77)
Relative to Issue Price (RP)	0.0010368	0.0010864	0.0011172
Return on Capital Employed (RoCE)	−0.148 ** (−2.34)	−0.145 ** (−2.31)	−0.143 ** (−2.28)
Constant	3.509 *** (22.95)	3.495 *** (22.78)	3.481 *** (22.62)
Observations	2568	2568	2568
R-squared	0.532	0.529	0.526

Note: t-statistics are enclosed in parentheses; Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

The lagged regression analysis further supports the original hypothesis (H1) that higher ESG ratings reduce a firm's sensitivity to SR. The consistent negative and significant impact of lagged ESGPS on SR across different lag lengths reaffirms the robustness of the original findings. These results suggest that the effect of ESG performance on reducing SR persists over time, providing additional evidence that incorporating ESG factors into corporate strategies can have long-term benefits in mitigating SR. The control variables' stable influence across the lagged models further emphasizes their importance in understanding the dynamics of systemic risk.

5. Implications

This study profoundly highlights crucial role of ESG performance in mitigating the SR sensitivity of Indian companies. In a globalized business environment, it is imperative for Indian firms to not only align with but also exceed international ESG standards to sustain and enhance their global competitiveness. By forging strategic partnerships with leading international entities and embracing cutting-edge management practices, Indian companies can significantly elevate their ESG initiatives, thereby enhancing their resilience to systemic risks.

For SMEs, an exclusive focus on short-term profitability can severely undermine long-term sustainability and growth. Our findings strongly advocate for SMEs to prioritize ESG investments and adhere rigorously to government directives aimed at enhancing social and environmental performance. Such an approach not only builds a robust corporate image but also attracts and retains responsible investors dedicated to sustainable development, ultimately enhancing long-term shareholder value.

This study establishes ESG performance as an essential tool for mitigating risks within financial markets, revealing a strong inverse relationship between ESG scores and sensitivity to SR. It underscores the critical need for integrating sustainability into corporate risk management frameworks, advancing our theoretical understanding of how ESG behaviors impact SR across diverse firm-specific factors like size, age, and K_d . Furthermore, the research makes significant contributions to stakeholder theory by showing the substantial influence of ESG performance on stakeholder perceptions, investor behavior, and overall market dynamics. This underscores the practical significance of ESG considerations in shaping corporate strategies and risk management outcomes.

Integrating ESG factors into corporate decision-making processes is not just advantageous but crucial for improving a firm's reputation, attracting responsible investors, and bolstering resilience against systemic risks. For investors, this research offers valuable

insights into the integration of ESG criteria into investment strategies, emphasizing the importance of ESG ratings as key indicators of a firm's financial resilience and risk profile.

The findings also serve as a call to action for policymakers and regulators to develop and enhance frameworks that promote sustainable business practices and strengthen financial market stability. Additionally, the study advocates for the establishment of strong corporate governance practices that prioritize transparency, accountability, and comprehensive stakeholder engagement—essential elements for effectively mitigating SR and safeguarding long-term shareholder value.

6. Conclusions

This research explores the intricate relationship between ESG performance and sensitivity to SR among firms listed on India's BSE 500 Index, utilizing data from 2018 to 2023. The study aligns with contemporary trends, examining the profound impact of ESG evaluations on business operations. By integrating global ESG assessment reports with annual disclosures, we employed a comprehensive review of the existing literature and multiple regression analysis to elucidate the SR-ESG performance nexus from a stakeholder-oriented perspective.

Our findings reveal a compelling correlation between a firm's ESG performance and its sensitivity to SR. Higher ESG ratings are linked to enhanced resilience against SR and reduced sensitivity. This highlights the crucial role of ESG-related responsibilities in mitigating SR. Two primary mechanisms drive this phenomenon. Elevated ESG ratings enhance consumer satisfaction and loyalty, stabilizing consumer purchases amid market volatility. Furthermore, transparent ESG disclosures attract stable investors, reduce information asymmetry, and enhance market capitalization potential. ESG investments also appeal to responsible investors, further bolstering resilience through subdued equity volatility, low turnover rates, and increased liquidity, thereby lowering susceptibility to financial market fluctuations and SR sensitivity.

Research indicates that the influence of ESG scores on the SR sensitivity of large-cap firms is markedly negligible, whereas small-cap firms can substantially reduce their SR exposure through robust ESG practices. This is because of the significant impact of ESG strategies and the diminishing returns on the ESG rating's influence on SR for these companies. Additionally, the ESG scores of older firms show minimal effect on their sensitivity to SR, whereas younger firms can significantly lower their SR exposure through strong ESG practices. This is attributed to the entrenched operational frameworks, historical stability, and established stakeholder relationships that characterize older firms, potentially diminishing the incremental risk mitigation benefits provided by ESG improvements.

Furthermore, the study reveals that firms with low borrowing costs show minimal sensitivity to SR from ESG scores, whereas those with higher borrowing costs can significantly reduce their SR exposure through strong ESG practices. Firms with lower borrowing costs generally have healthier financial profiles and less dependence on ESG performance for risk management, contrasting with firms facing higher financing costs that rely more on ESG enhancements to bolster their creditworthiness and overall risk profile.

This observed phenomenon can be ascribed to various dynamics, including the enhanced reputation and credibility enjoyed by companies with high ESG ratings (Bhattacharya et al. 2018). Moreover, the alignment of ESG principles with long-term time-to-value (Friede et al. 2015) and increasing acknowledgement among the investment community of the material impact of ESG factors on FP (Wu et al. 2022 further accentuate this trend. Additionally, the differential impact observed across firm-specific characteristics such as firm age, firm size, and K_d may stem from variances in financial resilience, governance frameworks, and strategic orientations among enterprises (Lins et al. 2017).

In summary, this study highlights how high-ESG-rated companies foster robust consumer loyalty and institutional investor trading structures, leading to diminished SR sensitivity. It concludes that companies boasting superior ESG ratings demonstrate lower SR sensitivity compared to firms with inferior ESG ratings. Additionally, it underscores

nuanced impact of ESG performance on SR across different segments with respect to firm size, elucidating the differential effects of leverage, firm age, and K_d .

7. Limitations and Directions for Further Research

This research provides important insights into how ESG performance correlates with sensitivity to systemic risk among firms in the Indian market. To extend these findings and delve into broader implications, several promising directions for future research could be explored. Broadening the analysis to include firms from various markets and regions may enhance the applicability of the results and offer a more complete picture of the impact of ESG performance on systemic risk across diverse contexts. Comparative studies between developed and emerging economies could provide a deeper understanding of how ESG practices influence systemic risk in different economic settings, thus enriching the global discourse on ESG's role in financial stability. Additionally, future research could focus on examining individual ESG components—environmental, social, and governance—separately, while also exploring their interactions with different financial and non-financial variables. This could reveal more detailed mechanisms underlying the observed relationships. Incorporating qualitative research methods might also offer a more nuanced view of how companies implement ESG strategies and how these practices affect their risk profiles.

Another fruitful area of investigation could be the application of quantile regression analysis to better understand the influence of firm characteristics such as age, size, and cost of debt on the relationship between ESG performance and systemic risk across different segments. Exploring alternative metrics of systematic risk, as suggested by Ellis et al. (2022), might also provide further insights into the robustness of the findings and potentially uncover different dynamics. Lastly, while this study focuses on the roles of firm size, age, and cost of debt, additional research could examine other firm-specific characteristics, like industry type and ownership structure, to further illuminate the relationship between ESG performance and systemic risk.

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Article

Twin Agency Problems and Debt Management around the World

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Abstract: This study examines the impact of twin agency problems (political corruption and minority shareholders' expropriation) on corporate debt management policies across a large number of countries. Our results show that in more corrupt countries, managers are more likely to shield liquid assets from potential political extraction by maintaining a higher level of leverage. This effect is magnified by the protection of shareholders' rights. We further show that twin agency problems influence not only the level of debt in capital structures but also other aspects of debt management, including debt maturity, deviation from optimal leverage, capital structure stability, and the leverage speed of adjustments. The findings are robust due to their inclusion of different measures of corruption and a wide range of firm-level and country-level characteristics. Our study has implications for policymakers, as we show that the improvement of the country-level institutional environment and, particularly, addressing corruption can lead to more effective debt management by firms, ultimately resulting in higher firm values.

Keywords: corruption; agency theory; leverage; speed of adjustment

1. Introduction

Academic research has focused extensively on investigating the consequences of corruption at both the national and organizational levels. Concurrently, numerous studies have examined the financial and economic consequences associated with the protection of minority shareholders' rights (MSPs). Traditionally, these two areas of research have been investigated in isolation from one another. However, Stulz (2005) argues that these two problems should be studied together as "twin agency problems", as in most cases, they exist concurrently. Twin agency problems are defined by Stulz (2005) as two simultaneously occurring problems: "the agency problem of corporate insider discretion" and "the agency problem of state ruler discretion".

In our study, we investigate the impact of corruption and minority shareholders' rights protection on firms' debt policies. While the goal of Stulz's (2005) work is relatively broad, as it suggests that the "twin agency problem" is one of the main factors that limit global financial development, we focus on one aspect that the "twin agency problem" can impact, which is debt financing. Debt is one of the major sources of external financing for companies. The proportion of debt in a capital structure can influence the cost of capital, which, in turn, impacts a firm's value. Additionally, debt is a source of financial risk, as too much debt can force a company into bankruptcy. Unlike a firm's business risk, which is often determined by the type of industry a company operates in, the degree of financial leverage (financial risk) can mainly be controlled by management (is mainly under management control). It has been shown that managers adjust levels of debt in response to changes in economic conditions (Hackbarth et al. 2006; Todorov 2020; Gao and Tsusaka 2023), political conditions (Pan et al. 2019; Basharat et al. 2022), and corporate governance (Chang et al. 2014; Gyimah et al. 2021).

Our analysis aims to shed light on variations in debt management across different countries by exploring the effects of corruption and MSP on various aspects of capital structure. Specifically, we examine their impact on deviations from the optimal capital structure, the speed at which firms adjust towards target (optimal) leverage, the maturity of their debt obligations, and the stability of capital structures.

We provide empirical evidence that the level of corruption among government officials has a distinct influence on debt management practices that is separate from the effects of actions taken by corporate insiders. We show that both the level of corruption and MSP significantly affect capital structure decisions, leverage deviations from target levels, the leverage speed of adjustment (SOA), and the utilization of short-term debt. More importantly, our findings remain robust even after accounting for a wide range of firm characteristics, country-level governance and economic indicators, and alternative measures of corruption and MSP indices.

Our study makes a number of notable contributions to the finance literature. First, it contributes to the emerging literature that recognizes the importance of simultaneously investigating the impact of twin agency problems. Second, it presents a comprehensive analysis of how twin agency problems impact various aspects of capital structure, deviations from optimal debt levels, and leverage SOA across a wide array of countries. Last, this research contributes to the existing literature by examining optimal capital structure and leverage SOA from the perspective of the twin agency problem. To the best of our knowledge, we are among the first researchers to examine corporate debt management from the twin agency perspective.

The remainder of the paper is structured as follows: In Section 2, we present a literature review. Section 3 outlines the methodology used in our study, detailing the main variables and data sources. Section 4 presents the empirical findings, and Section 5 provides concluding remarks summarizing our key findings.

2. Literature Review

2.1. Economic Impact of Corruption

The Enterprise Survey by the World Bank states that “Corruption by public officials may present a major administrative and financial burden on firms. Corruption creates an unfavorable business environment by undermining the operational efficiency of firms and raising the costs and risks associated with doing business”.¹

The adverse economic effects of corruption are significant at both national and corporate levels. Previous research has extensively documented the detrimental impact of corruption on a country’s economic and financial development. Hodge et al. (2011) illustrated how corruption impedes economic growth by undermining investments, political stability, and human capital development. Moreover, corruption has been found to diminish the return on investment by reducing investment efficiency (Swaleheen 2007; O’Toole and Tarp 2014). Several recent studies provided evidence that corruption impedes the economic development of countries. Examples of such studies include the analysis of the corruption effect on the Kenyan economy by Mose (2021), on MENA economies by Kirşanlı (2023), and on the economic growth of BRICS countries by Nizam et al. (2024). Additionally, Farinha and López-de-Foronda (2023) show that even in typically low-corruption regions, such as the European Union, corruption practices and perception have a negative impact on economic growth and innovations.

Some of the channels through which corruption can hinder economic growth include financial markets (Butler et al. 2009), innovations (Ellis et al. 2020; Farinha and López-de-Foronda 2023), and corporate investment (García-Gómez et al. 2022). Butler et al. (2009) investigated the consequences of state corruption on municipal bond issuance, revealing that higher levels of state corruption are associated with increased credit risk and higher bond yields. Overall, their results show a significant impact of corruption on financial markets.

At the firm level, prior research studies the impact of corruption on corporate innovation, firm value, corporate investment, and corporate financing policies. For instance, Ellis et al. (2020) investigated the relation between local political corruption and innovation within the private sector in the US. Their findings indicate that political corruption negatively affects the quality, quantity, and efficiency of firms' innovation in the US, underscoring the negative impact of corruption on firms' innovative activities. García-Gómez et al. (2022) documented the negative impact of corruption on corporate investments in Europe.

2.2. Impact of Corruption on Firm's Corporate Policies

Previous studies have documented the impact of political corruption on firms' financial policies in the United States. Smith (2016) shows that firms operating in US areas characterized by higher levels of corruption tend to exhibit lower cash holdings and higher debt levels in their capital structure compared to those in areas with lower corruption levels. These findings are consistent with the *asset-shielding hypothesis*, suggesting that firms may reduce liquidity and increase debt as a strategic measure to mitigate the risk of expropriation by local officials. Consequently, we expect that firms in countries with higher levels of corruption should have a higher proportion of debt in their capital structure, allowing them to minimize the funds susceptible to expropriation.

However, an alternative hypothesis posits that firms may want to maintain financial flexibility to facilitate bribe payments. Several finance studies provide evidence supporting this perspective, suggesting that certain firms may derive benefits from engaging in corrupt practices (e.g., Fisman 2001; Faccio et al. 2006; Duchin and Sosyura 2012). For instance, political connections can help firms gain preferential access to government contracts and financing. This would imply that countries with higher corruption levels may exhibit lower debt levels as firms prioritize financial flexibility to establish or strengthen their political ties.

Several studies have examined the relationship between legal and institutional environments and various aspects of debt management. For example, Öztekin and Flannery (2012) showed that stronger institutions lower the cost of leverage adjustments. Chang et al. (2014) documented that firms with weaker corporate governance adjusted slower towards target leverage. Zeitun and Goaid (2022) found that a low level of managerial ownership was associated with higher leverage SOA in Japan. Godlewski (2020) showed that stronger creditor protection has a positive impact on renegotiating debt maturity.

The results of studies examining the impact of corruption on debt management are somewhat mixed. For example, Fan et al. (2012) demonstrated that firms in more corrupt countries tend to hold more debt, particularly short-term debt, while Singh and Kannadhasan (2020) found a heterogeneous relationship between corruption and capital structure in emerging economies. Additionally, Hassan et al. (2022) showed that firms operating in areas with high political corruption in the US tend to adopt less short-term debt. Furthermore, while Tran et al. (2023) showed that leverage speed of adjustment (SOA) is negatively influenced by local corruption in Vietnam, Baxamusa and Jalal (2014) identified a non-linear relationship between corruption and SOA across multiple countries and showed that corruption increases the cost of debt and equity.

2.3. Twin Agency Problems

While the impact of corruption on corporate financial policies has been increasingly studied, the majority of these studies overlook the existence of the "twin agency problems" as described by Stulz (2005). The twin agency problems "arise because rulers of sovereign states and corporate insiders pursue their own interests at the expense of outside investors" (Stulz 2005, p. 1595). Stulz (2005) argued that a higher degree of government corruption prompts corporate actions aimed at minimizing state expropriation, such as reducing firm transparency. However, these actions also increase opportunities for corporate insiders to expropriate wealth from outside investors. Consequently, concentrated ownership becomes

more efficient than dispersed ownership, leading to a “principal–principal” conflict—an agency conflict which arises between majority and minority shareholders. Therefore, corporate financial policies worldwide often reflect not only the level of corruption in the country (potential wealth expropriation by state rulers) but also the severity of the “principal–principal” conflict and the strength of minority shareholders’ rights protection laws and regulations (Ellul 2008; Amin and Liu 2020; Cao et al. 2022). For example, Ellul (2008) showed that family firms in countries with weak minority shareholders’ protection have significantly higher leverage than non-family firms. Amin and Liu (2020) documented a non-linear association between debt financing and control ownership among Singaporean firms. Cao et al. (2022) found that the participation of minority shareholders in on-line voting leads to a reduced level of debt in the capital structure of Chinese firms.

In this study, we investigate the impact of the twin agency problem on capital structure across the globe, considering that a high level of debt can potentially serve as a mitigating mechanism for both twin agency problems. High debt levels enable firms to shield assets from state rulers’ expropriation while reducing incentives for controlling shareholders to maximize private benefits, as they risk losing control of the firm in the event of bankruptcy.

3. Methodology, Variable Definitions, and Data

3.1. Methodology

To evaluate the effect of corruption and MSP on debt management, we estimate the following model:

$$\text{Leverage}_{i,t+1} = \beta * \text{TAP Variables}_{i,t} + \gamma X_{i,t} + \delta Y_{j,t} + \eta Z_{j,t} + \varepsilon \quad (1)$$

where TAP (*Twin Agency Problems*) *Variables* are the corruption and MSP measures described below, β represents a vector of coefficients, $X_{i,t}$ is a vector of observable firm-level characteristics, and γ is a vector of coefficients. $Y_{j,t}$ is a vector of observable country-level economic and corporate governance factors, and δ is a vector of coefficients. $Z_{j,t}$ is a vector of cultural country-specific characteristics, and η is a vector of coefficients. We use ordinary least squares (OLS) regression to estimate Equation (1) and include industry and year fixed effects and firm-level clustering. Country fixed effects are included in the models wherever appropriate.

Our main dependent variable is the level of debt, *Leverage*, which is defined as the sum of short-term and long-term debt scaled by total assets. The main independent variable is *Control of Corruption* obtained from the World Bank Corporate Governance database. *Control of Corruption* evaluates how effectively corruption is controlled within a country and measures perceptions of the degree to which public officials use their power for private gain. It reflects how effective institutions, policies, and practices are in preventing corruption and ensuring accountability for wrongdoing. A *higher* score on the *Control of Corruption* indicates stronger anti-corruption management and better governance.

In order to account for the twin agency problems, we additionally include a measure of *minority shareholders’ protection*, which is the Guillen–Capron Shareholder Rights Index from Guillén and Capron (2016). Additionally, we include an *ownership concentration* measure, as Stulz (2005) showed that it is a crucial factor to consider when analyzing the twin agency problem’s implication for firms’ policies.

To control for firm-level factors, we include relevant firm characteristics such as size (measured as a log of total assets), market-to-book ratio (measured as total assets minus book equity plus market value of equity, scaled by total assets), tangibility (measured as tangible assets, such as property, plants, and equipment, scaled by total assets), and profitability (measured as earnings before interest and taxes scaled by total assets). These firm characteristics have been identified in the prior literature as main determinants of a firm’s capital structure (e.g., by Rajan and Zingales 1995).

To account for country-level characteristics, we include country economic and financial market variables from the World Bank, such as (log of) *GDP per capita*, *inflation* (measured by CPI), *domestic credit* (measured by domestic credit provided scaled by GDP), *market*

capitalization (total stock market value scaled by GDP), and *stock market turnover* (measured by total stock value traded divided by stock market capitalization). We also include *corporate tax rate* from the KPMG Global tax rate survey for 2003–2016.

Several prior studies, including those by Öztekin and Flannery (2012); Öztekin (2015); Singh and Kannadhasan (2020); Zeitun and Goaid (2022), showed that a country's corporate governance characteristics affect debt management. To control for corporate governance factors, we include the following measures from the World Bank Corporate Governance indicators: *Political Stability* (reflects perceptions of the likelihood of political instability), *Rule of Law* (measures perception of confidence in and compliance with the laws), *Government Effectiveness* (reflects perception of the quality of public and civil service, and extend of its independence from political pressures), *Regulatory Quality* (measures perceptions the government's ability to introduce and implement policies related to development of private sector), and *Voice and Accountability* (measures perceptions of the freedom of expression in the country and the ability of a country's citizens to participate in government selection process).

Finally, a number of studies showed that national culture impacts capital structure across different countries (e.g., Chui et al. 2002; Mogha and Williams 2021; Orlova and Harper 2022). To control for variability of country-level cultural characteristics, we include the following cultural variables based on Hofstede's cultural index (Hofstede 1980, 1983, 2001; Hofstede et al. 2010): *Individualism*, *Power Distance*, *Masculinity*, *Uncertainty Avoidance*, *Long-term Orientation*, and *Indulgence*².

3.2. Data

We obtained firm-level financial variables from the *Compustat Global* database for the 1995–2016 period. We ended our sample in 2016 because data on our key explanatory variable—minority shareholder protection—are only available until that year. We eliminated firms for which the total asset value is not available. Additionally, countries with less than 15 unique firms and missing values for our main variables of interest were eliminated from the sample. To reduce the effect of outliers, all firm-level variables were winsorized at the 1st and 99th percentiles³. We obtained the *Control of Corruption* measure from the World Bank Corporate Governance database. Guillén–Capron Shareholder Rights Index values were obtained from Guillén and Capron (2016). The *ownership concentration* measure was from La Porta et al. (2006) and Djankov et al. (2008). Corporate governance and economic and financial information were obtained from the World Bank's World Development Indicators database. The Hofstede's cultural dimensions index was used to measure cultural differences among countries.

Table 1 presents the summary statistics for the median value of leverage, firm size, degree of corruption, minority shareholder protection, and ownership concentration across countries. As shown in Table 1, our sample consisted of 35,269 unique firms from 57 countries. The median value of the debt-to-total assets ratio is 0.21. The median value for the *Control of Corruption* measure is 0.31, with Denmark showing the highest value of 2.43 and Nigeria showing the lowest value of (−1.13)⁴. *Minority Shareholders' Protection Index* (MSPI) values can potentially range from 0 to 10, as the index reflects 10 different legal provisions from countries' national legislations. The median value for MSPI in our sample is 5.5.

Table 2 presents correlation coefficients showing the relations between leverage, corruption, MSPI, ownership concentration, and various firm characteristics. Notably, we found a negative correlation between debt ratio and corruption. To further explore this relation, we next conducted multivariable analysis to investigate the association between leverage and corruption.

Table 1. Country-level summary statistics. This table reports summary statistics for all countries in our sample. Column 1 shows the country to which the analyzed firms belong. Column 2 reports the number of unique firms by country. Column 3 reports the median firm size. Columns 4 reports the median leverage ratio. Column 5 shows median values for the World Bank Control of Corruption variable. Column 6 reports the median Minority Shareholders Protection Index. Variables are as defined in the Section 3. The sample consists of all industrial firms in the Compustat file from 1995 to 2016, with non-missing observations on total assets.

Country Name	Unique Firms	Size	Leverage	Control of Corruption (WB)	Minority Shareholders Index
Argentina	61	5.77	0.18	−0.43	5.75
Australia	2249	2.93	0.03	1.97	6.75
Austria	123	6.27	0.23	1.95	4.50
Bangladesh	163	7.47	0.28	−0.91	2.00
Belgium	151	5.84	0.23	1.38	5.00
Brazil	297	6.47	0.26	−0.02	5.50
Bulgaria	49	4.65	0.23	−0.24	5.42
Canada	489	4.47	0.21	1.99	6.75
Chile	138	10.73	0.23	1.45	4.25
China	3221	7.17	0.18	−0.48	6.66
Colombia	37	13.64	0.11	−0.30	5.50
Cyprus	56	4.13	0.24	1.07	5.00
Czech Republic	23	8.36	0.16	0.33	5.25
Denmark	187	6.48	0.21	2.43	3.00
Egypt	131	6.48	0.14	−0.59	5.92
Finland	165	5.40	0.24	2.37	6.00
France	1047	5.30	0.19	1.36	7.00
Germany	985	4.87	0.14	1.86	6.00
Ghana	13	4.97	0.09	−0.07	4.50
Greece	231	4.95	0.32	0.25	5.00
Hong Kong	1185	6.78	0.15	1.81	6.90
India	3165	6.65	0.28	−0.42	5.88
Indonesia	374	13.36	0.28	−0.74	4.25
Italy	336	6.11	0.26	0.31	6.85
Japan	3965	10.55	0.21	1.23	7.00
Jordan	111	2.83	0.12	0.18	5.50
Kazakhstan	15	9.37	0.22	−0.91	8.25
Kenya	31	8.31	0.12	−0.97	3.00
Latvia	26	2.14	0.13	0.18	5.25
Lithuania	29	4.84	0.27	0.24	6.25
Luxembourg	37	6.77	0.23	2.06	6.25
Malaysia	1007	5.37	0.18	0.28	6.25
Mexico	133	9.20	0.23	−0.37	3.25
Netherlands	247	6.09	0.20	2.18	1.75
New Zealand	155	4.53	0.21	2.35	6.75
Nigeria	98	8.77	0.18	−1.13	5.25
Norway	319	6.48	0.22	2.17	5.25
Oman	52	2.70	0.19	0.28	5.16
Pakistan	314	7.74	0.34	−0.93	3.58
Peru	81	5.89	0.21	−0.30	5.00
Philippines	168	8.04	0.15	−0.53	3.15
Poland	549	4.58	0.13	0.49	7.57
Portugal	73	7.00	0.35	1.08	5.75
Russian Federation	175	9.33	0.23	−0.95	7.35
Singapore	775	4.88	0.17	2.21	7.25
Slovenia	27	7.03	0.27	0.89	6.50
South Africa	369	7.05	0.12	0.34	5.42
Spain	175	7.59	0.26	1.06	4.75

Table 1. Cont.

Country Name	Unique Firms	Size	Leverage	Control of Corruption (WB)	Minority Shareholders Index
Sweden	739	5.57	0.13	2.25	6.25
Switzerland	262	6.02	0.20	2.17	4.35
Thailand	545	7.59	0.24	−0.31	5.50
Turkey	306	5.64	0.18	0.03	5.90
Ukraine	19	7.76	0.10	−1.00	6.50
United Arab Emirates	42	6.87	0.13	1.08	4.00
United Kingdom	2853	3.80	0.13	1.89	6.63
United States	6327	3.31	0.23	1.39	6.25
Vietnam	369	13.19	0.23	−0.56	6.75
Total/median	35,269	6.47	0.21	0.31	5.50

Table 2. Correlation matrix. This table reports the correlation coefficients for leverage, firm characteristics, country-level corruption, and shareholder protections measures. All variables are as defined in the Section 3. The sample consists of all industrial firms in the Compustat Global database from 1995 to 2016.

VARIABLES	Leverage	Control of Corruption (WB)	Minority Shareholders Index	Size	Market-to-Book Ratio	Profitability	Tangibility
Leverage	1						
Control of Corruption (WB)	−0.1464	1					
Minority Shareholders Index	−0.0799	0.1912	1				
Size	0.1445	−0.2348	−0.0137	1			
Market-to-Book Ratio	−0.0271	0.1367	0.0412	−0.3449	1		
Profitability	−0.0043	−0.0029	−0.0003	0.0014	0.0001	1	
Tangibility	0.0027	0.0021	0.0003	−0.0166	0.05	−0.007	1

4. Empirical Results

4.1. Effect of Corruption on Level of Debt

Our initial empirical analysis focused on assessing the impact of corruption on the level of debt held by firms. The findings are summarized in Table 3, which presents the relationship between corruption and capital structure across various specifications. The table includes different specifications: column 1 considers only the corruption variable, column 2 includes corruption along with firm-level variables, column 3 adds country-level governance variables, column 4 incorporates country economic variables, and column 5 includes country-level cultural characteristics.

Across all specifications tested in our analysis, we consistently observed a negative and statistically significant coefficient on the *Control of Corruption* variable at the 1% level in Table 3. This finding indicates that firms exhibit a propensity to maintain higher levels of debt in countries characterized by weaker *Control of Corruption* (i.e., higher corruption). Our results are in line with Smith (2016), who found higher levels of debt for firms in higher-corruption areas in the US. This empirical evidence strongly supports the *shielding hypothesis*, which posits that firms strategically adjust their leverage levels in response to varying degrees of corruption within their operating environments. These results are consistent with firms strategically using higher debt levels as a defense against the risk of asset expropriation in corrupt countries. This approach helps firms to mitigate the impact of corruption on financial stability and protects assets from potential exploitation.

Table 3. Impact of Corruption on leverage. This table presents estimates of OLS regression with *leverage* as a dependent variable. Leverage is short-term debt plus long-term debt, divided by total assets. The main independent variables include *corruption*, *minority shareholder protection*, and *ownership concentration* measures, as defined in the Section 3. The control variables include firm- and country-level economic, institutional, and cultural characteristics. All variables are as defined in the Section 3. The sample consists of all industrial firms in the Compustat Global database from 1995 to 2016. All specifications include industry and year fixed effects. Standard errors (in parentheses) are heteroskedasticity-consistent and clustered at the firm level. Significance levels are indicated as follows: * = 10%, ** = 5%, *** = 1%.

VARIABLES	Leverage	Leverage	Leverage	Leverage	Leverage
	(1)	(2)	(3)	(4)	(5)
<i>Control of Corruption (WB)</i>	−0.0169 *** (0.0010)	−0.0133 *** (0.0010)	−0.0281 *** (0.0037)	−0.0357 *** (0.0046)	−0.0276 *** (0.0053)
<i>Size</i>		0.0073 *** (0.0004)	0.0080 *** (0.0004)	0.0085 *** (0.0005)	0.0078 *** (0.0006)
<i>Market-to-book Ratio</i>		0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
<i>Profitability</i>		−0.0000 (0.0000)	−0.0000 (0.0000)	0.0000 (0.0000)	−0.0000 *** (0.0000)
<i>Tangibility</i>		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 ** (0.0000)	0.0000 * (0.0000)
<i>Government Effectiveness</i>			−0.0256 *** (0.0044)	−0.0057 (0.0054)	−0.0427 *** (0.0067)
<i>Political Stability</i>			−0.0261 *** (0.0022)	−0.0151 *** (0.0029)	−0.0060 * (0.0032)
<i>Regulatory Quality</i>			0.0056 * (0.0034)	−0.0130 ** (0.0063)	−0.0071 (0.0065)
<i>Rule of Law</i>			0.0533 *** (0.0049)	0.0595 *** (0.0071)	0.0513 *** (0.0074)
<i>Voice and Accountability</i>			0.0116 *** (0.0019)	0.0134 *** (0.0024)	0.0278 *** (0.0038)
<i>GDP</i>				0.0016 (0.0025)	0.0182 *** (0.0032)
<i>Inflation</i>				−0.0005 (0.0004)	0.0004 (0.0004)
<i>Domestic Credit</i>				−0.0003 *** (0.0000)	−0.0001 ** (0.0000)
<i>Tax Rate</i>				0.0008 *** (0.0003)	0.0018 *** (0.0003)
<i>Market Capitalization</i>				0.0000 *** (0.0000)	−0.0000 *** (0.0000)
<i>Stocks traded turnover</i>				−0.0001 *** (0.0000)	−0.0001 *** (0.0000)
<i>Power Distance</i>					0.0003 ** (0.0001)
<i>Individualism</i>					−0.0003 ** (0.0001)
<i>Masculinity</i>					−0.0009 *** (0.0001)
<i>Uncertainty Avoidance</i>					−0.0007 *** (0.0001)
<i>Long-term Orientation</i>					−0.0002 (0.0001)
<i>Indulgence</i>					−0.0007 *** (0.0001)
<i>Observations</i>	362,961	213,751	213,751	130,452	126,243
<i>R-squared</i>	0.0696	0.0805	0.0904	0.0916	0.0985

4.2. Effect of Twin Agency Problems on Level of Debt

Next, we investigated the impact of the twin agency problems on capital structure, incorporating *MSPI* variable into our regression. Additionally, we included the *Ownership Concentration* variable, given its increased prevalence in environments where twin agency problems are more acute. The findings presented in Table 4 show a positive relation between minority shareholders' rights protection and the level of debt in capital structures. This relation holds across all specifications, with the coefficient on the *MSPI* variable consistently demonstrating significance levels of 10% or better. These results imply that stronger minority shareholders' protection is linked to higher debt levels within the capital structure. The results are consistent with the idea that higher minority shareholder protection reduces the risk of expropriation, boosting investor confidence and facilitating firms' access to debt financing. This, in turn, leads to higher leverage ratios.

Table 4. Twin agency problems' impact on leverage. This table presents estimates of OLS regression with *leverage* as a dependent variable. Leverage is the sum of short-term debt and long-term debt, scaled by total assets. The main independent variables include *corruption*, *minority shareholder protection*, and *ownership concentration* measures, as defined in the Section 3. The control variables include firm- and country-level characteristics. All variables are as defined in the Section 3. The sample consists of 35,269 unique firms from the Compustat Global database from 1995 to 2016. All models include industry and year fixed effects and clustering at the firm level. Standard errors (in parentheses) are heteroskedasticity-consistent. Significance levels are indicated as follows: * = 10%, ** = 5%, *** = 1%.

VARIABLES	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage
	(1)	(2)	(3)	(4)	(5)	(6)
Control of Corruption (WB)		−0.0500 *** (0.0062)			−0.0265 *** (0.0053)	−0.0414 *** (0.0061)
Minority Shareholders Index	0.0033 * (0.0019)	0.0048 ** (0.0019)		0.0104 *** (0.0021)		0.0112 *** (0.0021)
Ownership Concentration			0.0017 *** (0.0002)	0.0022 *** (0.0002)	0.0017 *** (0.0002)	0.0019 *** (0.0002)
Size	0.0080 *** (0.0006)	0.0082 *** (0.0006)	0.0088 *** (0.0006)	0.0091 *** (0.0006)	0.0087 *** (0.0006)	0.0091 *** (0.0006)
Market-to-book Ratio	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Profitability	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)
Tangibility	0.0000 * (0.0000)	0.0000 * (0.0000)	0.0000 * (0.0000)	0.0000 * (0.0000)	0.0000 * (0.0000)	0.0000 * (0.0000)
Government Effectiveness	−0.0526 *** (0.0065)	−0.0310 *** (0.0071)	−0.0490 *** (0.0062)	−0.0416 *** (0.0064)	−0.0375 *** (0.0069)	−0.0250 *** (0.0071)
Political Stability	−0.0085 ** (0.0035)	−0.0064 * (0.0034)	−0.0037 (0.0035)	−0.0021 (0.0038)	−0.0021 (0.0035)	−0.0010 (0.0037)
Regulatory Quality	−0.0008 (0.0071)	0.0058 (0.0070)	−0.0066 (0.0067)	0.0005 (0.0072)	−0.0044 (0.0067)	0.0060 (0.0071)
Rule of Law	0.0245 *** (0.0081)	0.0491 *** (0.0088)	0.0388 *** (0.0074)	0.0186 ** (0.0081)	0.0524 *** (0.0079)	0.0394 *** (0.0087)
Voice and Accountability	0.0366 *** (0.0045)	0.0382 *** (0.0045)	0.0170 *** (0.0043)	0.0227 *** (0.0047)	0.0157 *** (0.0043)	0.0257 *** (0.0047)
GDP	0.0125 *** (0.0034)	0.0143 *** (0.0034)	0.0069 ** (0.0032)	−0.0011 (0.0035)	0.0093 *** (0.0032)	0.0018 (0.0035)
Inflation	0.0002 (0.0004)	0.0001 (0.0004)	0.0003 (0.0004)	−0.0003 (0.0005)	0.0003 (0.0004)	−0.0003 (0.0005)
Domestic Credit	−0.0000 (0.0000)	−0.0001 ** (0.0000)	0.0000 (0.0000)	0.0001 ** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Tax Rate	0.0013 *** (0.0003)	0.0016 *** (0.0003)	0.0012 *** (0.0003)	0.0010 *** (0.0003)	0.0015 *** (0.0003)	0.0012 *** (0.0003)
Market Capitalization	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)
Stocks Traded Turnover	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)	−0.0001 *** (0.0000)
Power Distance	0.0003 ** (0.0001)	−0.0001 (0.0002)	0.0004 *** (0.0001)	−0.0001 (0.0001)	0.0002 (0.0001)	−0.0004 *** (0.0002)
Individualism	−0.0004 *** (0.0001)	−0.0006 *** (0.0002)	0.0003 ** (0.0001)	0.0002 (0.0002)	0.0003 ** (0.0001)	−0.0000 (0.0002)
Masculinity	−0.0012 *** (0.0001)	−0.0012 *** (0.0001)	−0.0011 *** (0.0001)	−0.0014 *** (0.0001)	−0.0010 *** (0.0001)	−0.0014 *** (0.0001)
Uncertainty Avoidance	−0.0006 *** (0.0001)	−0.0007 *** (0.0001)	−0.0005 *** (0.0001)	−0.0005 *** (0.0001)	−0.0006 *** (0.0001)	−0.0006 *** (0.0001)
Long-term Orientation	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0002 ** (0.0001)	0.0001 (0.0001)	0.0002 ** (0.0001)
Indulgence	−0.0006 *** (0.0001)	−0.0005 *** (0.0001)	−0.0009 *** (0.0001)	−0.0007 *** (0.0001)	−0.0009 *** (0.0001)	−0.0006 *** (0.0001)
Observations	117,194	117,194	124,285	115,654	124,285	115,654
R-squared	0.0996	0.1010	0.0992	0.1008	0.0997	0.1017

Notably, the coefficients on *Control of Corruption* variables remained negative and statistically significant across all models. This finding means that country-level control of corruption impacts levels of debt, even after we account for other significant factors. These results confirm the notion that firms in environments characterized by weaker control of corruption tend to opt for higher levels of leverage as a defensive mechanism against potential risks of expropriation.

We proceeded to assess whether the relations between leverage and twin agency problem measures observed in the full sample hold across different subsamples. The results are presented in Table 5. When we examined the subsample of common law countries versus other countries separately, we found that the sign and statistical significance of the coefficients associated with *Control of Corruption* and *MSPI* remained consistent and unchanged compared to the full sample. This means that a higher level of corruption is associated with a higher debt level in both groups of common law countries and non-common law countries. Comparing developed and developing countries, we observed different patterns. In the subsample of developed countries, there is a statistically significant negative relationship between *Control of Corruption* and debt level; however, the coefficient on *MSPI* is insignificant. However, in the subsample of developing countries, the relation between *Control of Corruption* and leverage loses significance, meaning we did not find that corruption has an impact on leverage in developing countries. However, the *MSPI* coefficient exhibited a positive and statistically significant relation at the 1% level. This implies that a strong MSP leads to a higher amount of debt in the capital structure in developing countries.

Table 5. Twin agency problems' impact on leverage based on legal origin and economic development. This table presents estimates of OLS regression with *leverage* as a dependent variable. Leverage is the sum of short-term debt and long-term debt, scaled by total assets. The main independent variables include *corruption*, *minority shareholder protection*, and *ownership concentration* measures, as defined in the Section 3. The control variables include firm- and country-level characteristics. All variables are as defined in the Section 3. The sample consists of 35,269 unique firms from the Compustat Global database from 1995 to 2016. All models include industry and year fixed effects and clustering at the firm level. Standard errors (in parentheses) are heteroskedasticity-consistent. Significance levels are indicated as follows: * = 10%, ** = 5%, *** = 1%.

VARIABLES	Leverage		Leverage	
	Common Law = 1 (1)	Common Law = 0 (2)	Developed = 1 (3)	Developed = 0 (4)
<i>Control of Corruption (WB)</i>	−0.0323 ** (0.0134)	−0.0781 *** (0.0084)	−0.0318 *** (0.0113)	0.0090 (0.0086)
<i>Minority Shareholders Index</i>	0.0298 *** (0.0064)	0.0131 *** (0.0029)	0.0061 (0.0059)	0.0090 *** (0.0025)
<i>Ownership Concentration</i>	−0.0057 *** (0.0019)	0.0033 *** (0.0004)	0.0030 ** (0.0012)	0.0010 *** (0.0004)
<i>Size</i>	0.0154 *** (0.0011)	0.0042 *** (0.0008)	0.0066 *** (0.0010)	0.0120 *** (0.0009)
<i>Market-to-book Ratio</i>	0.0001 *** (0.0000)	0.0000 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)
<i>Profitability</i>	−0.0002 (0.0002)	−0.0000 *** (0.0000)	−0.0009 *** (0.0003)	−0.0000 (0.0000)
<i>Tangibility</i>	0.0000 *** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 *** (0.0000)
<i>GDP</i>	−0.0055 (0.0143)	−0.0054 (0.0042)	−0.0188 (0.0127)	−0.0224 *** (0.0057)
<i>Inflation</i>	−0.0032 *** (0.0007)	−0.0055 *** (0.0006)	−0.0102 *** (0.0016)	−0.0006 (0.0005)
<i>Domestic Credit</i>	0.0001 (0.0001)	0.0004 *** (0.0000)	0.0004 *** (0.0001)	−0.0001 (0.0001)

Table 5. Cont.

VARIABLES	Leverage		Leverage	
	Common Law = 1 (1)	Common Law = 0 (2)	Developed = 1 (3)	Developed = 0 (4)
Tax Rate	0.0036 *** (0.0009)	0.0000 (0.0004)	−0.0016 * (0.0008)	0.0053 *** (0.0006)
Market Capitalization	−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0003 *** (0.0001)	−0.0000 (0.0000)
Stocks Traded Turnover	−0.0002 *** (0.0001)	−0.0001 *** (0.0000)	−0.0002 *** (0.0000)	−0.0001 *** (0.0000)
Government Effectiveness	0.0177 (0.0128)	−0.0004 (0.0099)	−0.0117 (0.0115)	0.0171 * (0.0101)
Political Stability	0.0257 *** (0.0087)	0.0154 *** (0.0056)	−0.0312 *** (0.0090)	0.0026 (0.0053)
Regulatory Quality	−0.0232 (0.0148)	−0.0035 (0.0098)	−0.0210 (0.0148)	0.0116 (0.0094)
Rule of Law	0.0376 * (0.0220)	0.0351 *** (0.0110)	0.0474 * (0.0243)	0.0082 (0.0108)
Voice and Accountability	0.0069 (0.0130)	0.0251 *** (0.0079)	−0.0190 (0.0188)	−0.0013 (0.0066)
Power Distance	0.0002 (0.0008)	0.0000 (0.0003)	−0.0002 (0.0008)	−0.0005 * (0.0003)
Individualism	−0.0018 ** (0.0007)	0.0002 (0.0002)	0.0002 (0.0004)	0.0003 (0.0003)
Masculinity	0.0045 *** (0.0010)	−0.0018 *** (0.0001)	−0.0012 *** (0.0003)	−0.0009 *** (0.0002)
Uncertainty Avoidance	0.0077 *** (0.0020)	−0.0007 *** (0.0002)	−0.0003 (0.0006)	0.0003 (0.0002)
Long-term Orientation	0.0083 *** (0.0023)	0.0004 ** (0.0002)	−0.0009 *** (0.0002)	0.0004 * (0.0002)
Indulgence	0.0029 *** (0.0009)	0.0002 (0.0002)	−0.0004 (0.0004)	−0.0005 *** (0.0002)
Observations	52,744	73,241	52,287	73,698
R-squared	0.1430	0.0776	0.1069	0.1153

One possible explanation for these findings is that developed countries are characterized by more mature and liquid financial markets, with better access to information and investor activism. In these environments, there is less of a need to use more leverage, as existing well-established legal and regulatory mechanisms help to ensure fair treatment of minority shareholders and mitigate the risk of exploitation by majority shareholders. Additionally, firms in developing countries might have limited access to formal financing sources such as bank loans or capital markets and rely more heavily on informal channels, where corruption may play a less important role.

4.3. Estimation of Optimal Level of Debt and Leverage SOA

Although the analysis of how corruption and protection of minority shareholders' rights affect capital structure provides insights into variations in debt levels across countries, it does not determine whether these observed debt levels are optimal for individual firms in terms of maximizing value, nor does it offer insights into the stability of the capital structure and debt maturity.

The tradeoff theory of capital structure argues that each firm has an optimal level of debt that maximizes firm value by balancing the costs and benefits of debt financing. However, due to market frictions, deviations from the optimal capital structure may occur. Therefore, firms should aim to return to their optimal debt level as quickly as possible. Since an optimal level of debt is unobservable, the most common approach in the literature

is to use the partial adjustment model to estimate the target level of debt and speed of adjustment to this target (SOA)⁵:

$$Lev_{i,t+1} - Lev_{i,t} = \lambda (Lev_{i,t+1}^* - Lev_{i,t}) + \delta_{i,t+1} \quad (2)$$

$$Lev_{i,t+1}^* = \beta X_{i,t} \quad (3)$$

$$Lev_{i,t+1} = (\lambda \beta) X_{i,t} + (1 - \lambda) Lev_{i,t} + \delta_{i,t+1} \quad (4)$$

- λ coefficient is the adjustment speed towards target, i.e., leverage SOA;
- Lev^* is the firm's target ratio.

$X_{i,t}$ is a vector of various firm- and country-level determinants of the firm's optimal level of debt, such as market-to-book ratio, size, profitability, tangibility, industry, and firm fixed effects. β represents a vector of respective coefficients. The λ coefficient, leverage SOA, represents the proportion of the gap between actual level of debt and the optimal capital structure that a firm is able to close each year.

Following Öztekin and Flannery (2012); Öztekin (2015), we used a two-step system generalized method of moments (GMM) estimator (Blundell and Bond 1998) to estimate Equation (4) to determine leverage SOA for each country. Next, we used estimates of β s and λ to calculate the optimal level of debt (using Equation (3)), and deviation from the target was estimated by subtracting the actual ratio of debt in the capital structure for each firm-year from the estimated optimal level of debt (Equation (5)):

$$\widehat{DEV}_{i,t+1} = \widehat{Cash}_{i,t+1}^* - Cash_{i,t} \quad (5)$$

We used our estimates of the leverage SOA and deviation from the optimal capital structure as dependent variables in our main specification (Equation (1)). A higher leverage SOA means that firms return to their optimal level of leverage relatively quickly. Additionally, we examined the impact of twin agency problems on the debt maturity and stability of the capital structure. We created an indicator variable that equals 1 if a firm issues notes payable (short-term debt); otherwise, it is 0. We estimated debt volatility as a standard deviation of the level of debt for each firm. A higher standard deviation of debt level implies a less stable (more volatile) capital structure. We included the notes payable (short-term debt) indicator variable and leverage volatility as dependent variables in Equation (1). The effect of twin agency problems on debt maturity, deviation from target, capital structure stability, and leverage SOA were evaluated by regressing the dependent variables described above on *Control of Corruption*, *MSPI*, and ownership concentration variables. In line with our previous specifications, we also included firm- and country-level variables into our models. The specifications were estimated using OLS regression and included industry and year fixed effects, and firm clustering. Table 6 shows the results of our estimates.

The results presented in column 1 of Table 6 show that in countries with higher control of corruption and lower degree of MSP, firms use short-term financing less than in more corrupt countries and countries with higher MSP. The results are statistically significant at the 1% level. This finding is in contrast with the results of Hassan et al.'s (2022) study, which showed that firms in a high political corruption area in the US hold less short-term debt. The difference in results can potentially be due to the fact that Hassan et al.'s (2022) study focused on the US, which has more developed financial markets and an overall low level of corruption. We further observed that firms in more corrupt countries deviate more from the optimal level of debt (column 2), and their capital structure is less stable (column 3). This can potentially lead to a decrease in firm value⁶. A higher level of MSP and ownership concentration amplify the effect. The coefficients are significant at the 1% level. The results in columns 4–6 of Table 6 indicate that while in the full sample, corruption does not have a statistically significant impact on leverage SOA, a lower level of corruption (or a higher level of *Control of Corruption*) has a positive statistically significant effect on

leverage adjustments for over-levered firms (firms with an excess amount of debt). This finding implies that in high-corruption countries, firms holding too much debt are slow to decrease their leverage towards an optimal level. This is consistent with the idea that firms in more corrupt countries hold higher (than optimal) amounts of debt in order to shield their assets from expropriation. This supports the finding of Tran et al. (2023) that linked a higher level of corruption to a slow leverage SOA in Vietnam. This finding is also in line with previous studies that argued that weaker legal institutions increase the costs of leverage adjustment (Öztekin and Flannery 2012; Chang et al. 2014).

Table 6. Twin agency problems' impact on various aspects of debt management. This table presents the results of the impact of twin agency problems on debt maturity, leverage deviation from optimal level, capital structure stability, and the leverage SOA. Dependent variables used are short-term debt use (column 1), deviation from optimal leverage (column 2), leverage volatility (column 3), and leverage SOA (columns 4–6). The short-term debt use is an indicator variable equal to 1 if a firm uses notes payable in its capital structure. Deviation from optimal leverage is $D\hat{E}V_{i,t+1} = \hat{L}ev_{i,t+1} - Lev_{i,t}$, where Lev^* is target leverage. In column 4, Leverage SOA is estimated using the BB GMM estimator (Blundell and Bond 1998). The following specification is estimated: $Lev_{i,t+1} = (\lambda\beta)X_{i,t} + (1-\lambda)Lev_{i,t} + \delta_{i,t+1}$, where $X_{i,t}$ is a vector of observable firm-level determinants of factors of the target capital structure, β is a vector of coefficients, and λ coefficient represents the leverage SOA. The main independent variables include *corruption*, *minority shareholder protection*, and *ownership concentration* measures, as defined in the Section 3. The control variables include firm- and country-level characteristics. The sample consists of 35,269 unique firms from the Compustat Global database from 1995 to 2016. The standard errors are heteroskedasticity-consistent. Significance levels are indicated as follows: * = 10%, ** = 5%, *** = 1%.

VARIABLES	Short-Term Debt (1)	Deviation from Optimal Leverage (2)	Leverage Volatility (3)	Leverage SOA (4)	Leverage SOA Under-Levered (5)	Leverage SOA Over-Levered (6)
Control of Corruption (WB)	−0.1072 *** (0.0122)	−0.0287 *** (0.0020)	−0.0133 *** (0.0008)	0.0009 (0.0022)	−0.0008 (0.0028)	0.0292 *** (0.0013)
Minority Shareholders Index	0.0250 *** (0.0041)	0.0316 *** (0.0007)	0.0020 *** (0.0003)	−0.0151 *** (0.0005)	−0.0096 *** (0.0009)	−0.0218 *** (0.0005)
Ownership Concentration	0.0033 *** (0.0005)	0.0044 *** (0.0001)	0.0003 *** (0.0000)	−0.0044 *** (0.0001)	−0.0026 *** (0.0002)	−0.0052 *** (0.0001)
Size	0.0573 *** (0.0011)	−0.0054 *** (0.0002)	0.0003 *** (0.0001)	0.0002 (0.0001)	−0.0011 *** (0.0002)	0.0015 *** (0.0001)
Market-to-book Ratio	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Profitability	−0.0000 *** (0.0000)	−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 ** (0.0000)	0.0000 *** (0.0000)	−0.0000 ** (0.0000)
Tangibility	0.0000 * (0.0000)	0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 (0.0000)
Government Effectiveness	0.0483 *** (0.0135)	−0.0376 *** (0.0021)	0.0076 *** (0.0009)	−0.0063 *** (0.0019)	−0.0343 *** (0.0027)	0.0083 *** (0.0018)
Political Stability	0.0017 (0.0069)	0.0050 *** (0.0016)	−0.0019 *** (0.0007)	0.0259 *** (0.0009)	0.0186 *** (0.0016)	0.0331 *** (0.0011)
Regulatory Quality	−0.0019 (0.0145)	−0.0141 *** (0.0021)	−0.0120 *** (0.0012)	0.0619 *** (0.0022)	0.0502 *** (0.0039)	0.0775 *** (0.0019)
Rule of Law	0.1182 *** (0.0175)	0.0614 *** (0.0028)	−0.0031 ** (0.0014)	−0.0568 *** (0.0039)	−0.0382 *** (0.0050)	−0.1088 *** (0.0034)
Voice and Accountability	−0.1075 *** (0.0089)	−0.0007 (0.0014)	0.0306 *** (0.0005)	−0.0329 *** (0.0017)	−0.0216 *** (0.0025)	−0.0325 *** (0.0019)
GDP	−0.0139 ** (0.0070)	−0.0324 *** (0.0007)	0.0022 *** (0.0004)	0.0238 *** (0.0008)	0.0307 *** (0.0012)	0.0164 *** (0.0007)
Inflation	−0.0038 *** (0.0009)	−0.0012 *** (0.0002)	0.0003 *** (0.0001)	−0.0008 *** (0.0001)	−0.0010 *** (0.0002)	0.0007 *** (0.0001)
Domestic Credit	0.0005 *** (0.0001)	0.0000 *** (0.0000)	0.0001 *** (0.0000)	−0.0006 *** (0.0000)	−0.0005 *** (0.0000)	−0.0005 *** (0.0000)
Tax Rate	0.0020 *** (0.0006)	−0.0010 *** (0.0001)	0.0007 *** (0.0000)	−0.0032 *** (0.0001)	−0.0056 *** (0.0001)	−0.0008 *** (0.0001)
Market Capitalization	−0.0001 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)
Stocks Traded Turnover	−0.0001 *** (0.0000)	0.0001 *** (0.0000)	−0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Power Distance	0.0013 *** (0.0003)	−0.0005 *** (0.0001)	−0.0002 *** (0.0000)	0.0002 *** (0.0000)	0.0003 *** (0.0001)	0.0003 *** (0.0000)
Individualism	0.0024 *** (0.0003)	0.0013 *** (0.0000)	−0.0007 *** (0.0000)	0.0021 *** (0.0000)	0.0022 *** (0.0001)	0.0021 *** (0.0000)
Masculinity	−0.0024 *** (0.0002)	−0.0017 *** (0.0000)	−0.0001 *** (0.0000)	0.0004 *** (0.0000)	0.0003 *** (0.0000)	0.0004 *** (0.0000)
Uncertainty Avoidance	0.0004 ** (0.0002)	−0.0000 (0.0000)	−0.0008 *** (0.0000)	0.0004 *** (0.0000)	0.0005 *** (0.0000)	−0.0004 *** (0.0000)
Long-term Orientation	0.0003 (0.0002)	0.0014 *** (0.0000)	−0.0008 *** (0.0000)	−0.0010 *** (0.0000)	−0.0007 *** (0.0000)	−0.0016 *** (0.0000)
Indulgence	−0.0021 *** (0.0003)	0.0007 *** (0.0001)	0.0000 (0.0000)	−0.0005 *** (0.0000)	−0.0005 *** (0.0001)	−0.0007 *** (0.0000)
Observations	125,985	111,434	117,570	117,122	37,936	79,186
R-squared	0.2499	0.7978	0.7502	0.8922	0.9215	0.9209

4.4. Alternative Measure of Corruption

In order to verify the robustness of our findings and to mitigate any potential biases arising from the choice of corruption measure, we employed an alternative measure of corruption sourced from the International Risk Country Guide Database. This corruption measure ranges from 0 to 6, where “6” denotes low corruption, and “0” denotes high corruption levels. The results of this analysis are summarized in Table 7. Remarkably, all estimates generated from this alternative corruption measure are consistent with our previous findings. This consistency across the measures confirms the significant association between corruption levels and firms’ debt management decisions.

Table 7. Twin agency problems’ impact on leverage with alternative measure of corruption. This table presents results of the impact of twin agency problems on debt maturity, leverage deviation from target, leverage stability, and the speed of adjustment. Dependent variables used are short-term debt use (column 1), deviation from optimal leverage (column 2), leverage volatility (column 3), and leverage SOA (columns 4–6). The short-term debt use is an indicator variable equal to 1 if a firm uses notes payable in its capital structure. Deviation from optimal leverage is $\hat{D}\hat{E}V_{i,t+1} = \hat{L}ev_{i,t+1}^* - Lev_{i,t}$, where Lev^* is target leverage. In column 4, leverage SOA is estimated using the BB GMM estimator (Blundell and Bond 1998). The following specification is estimated: $Lev_{i,t+1} = (\lambda\beta)X_{i,t} + (1-\lambda)Lev_{i,t} + \delta_{i,t+1}$, where $X_{i,t}$ is a vector of observable firm-level determinants of factors of the target capital structure, β is a vector of coefficients, and λ coefficient represents the leverage SOA. The main independent variables include *corruption*, *minority shareholder protection*, and *ownership concentration* measures, as defined in the Section 3. The control variables include firm- and country-level characteristics. The sample consists of 35,269 unique firms from the Compustat Global database from 1995 to 2016. The standard errors are heteroskedasticity-consistent. Significance levels are indicated as follows: * = 10%, ** = 5%, *** = 1%.

	Leverage	Short-Term Debt	Deviation from Optimal Leverage	Leverage Volatility	Leverage SOA	Leverage SOA Under-Levered	Leverage SOA Over-Levered
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Corruption Measure from IRCCG	−0.0008 *** (0.0001)	−0.0034 *** (0.0002)	−0.0012 *** (0.0000)	−0.0002 *** (0.0000)	0.0004 *** (0.0000)	0.0004 *** (0.0000)	0.0006 *** (0.0000)
Minority Shareholders Index	0.0079 *** (0.0021)	0.0181 *** (0.0041)	0.0294 *** (0.0006)	0.0015 *** (0.0003)	−0.0146 *** (0.0004)	−0.0090 *** (0.0009)	−0.0200 *** (0.0005)
Ownership Concentration	0.0019 *** (0.0002)	0.0039 *** (0.0005)	0.0045 *** (0.0001)	0.0003 *** (0.0000)	−0.0044 *** (0.0001)	−0.0026 *** (0.0002)	−0.0053 *** (0.0001)
Size	0.0084 *** (0.0006)	0.0580 *** (0.0011)	−0.0050 *** (0.0002)	0.0004 *** (0.0001)	0.0001 (0.0001)	−0.0014 *** (0.0002)	0.0014 *** (0.0001)
Market-to-book Ratio	0.0001 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Profitability	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 *** (0.0000)	0.0000 *** (0.0000)	−0.0000 ** (0.0000)
Tangibility	0.0000 *** (0.0000)	0.0000 * (0.0000)	0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 (0.0000)
Government Effectiveness	−0.0162 ** (0.0063)	0.0410 ** (0.0126)	−0.0355 *** (0.0016)	0.0034 *** (0.0008)	−0.0104 *** (0.0017)	−0.0397 *** (0.0022)	0.0124 *** (0.0017)
Political Stability	0.0019 (0.0037)	0.0216 *** (0.0071)	0.0144 *** (0.0017)	−0.0021 *** (0.0007)	0.0229 *** (0.0009)	0.0172 *** (0.0016)	0.0294 *** (0.0012)
Regulatory Quality	−0.0130 * (0.0070)	−0.0173 (0.0145)	−0.0200 *** (0.0021)	−0.0124 *** (0.0012)	0.0631 *** (0.0023)	0.0495 *** (0.0039)	0.0811 *** (0.0018)
Rule of Law	0.0192 ** (0.0079)	0.1022 *** (0.0165)	0.0579 *** (0.0023)	−0.0079 *** (0.0013)	−0.0604 *** (0.0037)	−0.0406 *** (0.0049)	−0.0980 *** (0.0034)
Voice and Accountability	0.0224 *** (0.0045)	−0.1143 *** (0.0088)	−0.0013 (0.0013)	0.0298 *** (0.0006)	−0.0329 *** (0.0017)	−0.0224 *** (0.0026)	−0.0317 *** (0.0019)
GDP	−0.0026 (0.0035)	−0.0319 *** (0.0070)	−0.0376 *** (0.0008)	0.0010 ** (0.0004)	0.0251 *** (0.0007)	0.0313 *** (0.0012)	0.0198 *** (0.0007)
Inflation	−0.0016 *** (0.0004)	−0.0022 ** (0.0009)	−0.0005 *** (0.0001)	0.0005 *** (0.0001)	−0.0010 *** (0.0001)	−0.0011 *** (0.0002)	0.0001 (0.0001)
Domestic Credit	0.0000 (0.0000)	0.0004 *** (0.0001)	0.0001 *** (0.0000)	0.0001 *** (0.0000)	−0.0006 *** (0.0000)	−0.0005 *** (0.0000)	−0.0005 *** (0.0000)
Tax Rate	0.0019 *** (0.0003)	0.0027 *** (0.0006)	−0.0008 *** (0.0001)	0.0007 *** (0.0000)	−0.0033 *** (0.0001)	−0.0058 *** (0.0001)	−0.0009 *** (0.0001)
Market Capitalization	−0.0000 *** (0.0000)	−0.0001 *** (0.0000)	−0.0000 *** (0.0000)	−0.0000 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)
Stocks Traded Turnover	−0.0001 *** (0.0000)	−0.0002 *** (0.0000)	0.0001 *** (0.0000)	−0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)
Power Distance	−0.0006 *** (0.0000)	0.0010 *** (0.0000)	−0.0006 *** (0.0000)	−0.0002 *** (0.0000)	0.0003 *** (0.0000)	0.0004 *** (0.0000)	0.0002 *** (0.0000)

Table 7. Cont.

	Leverage	Short-Term Debt	Deviation from Optimal Leverage	Leverage Volatility	Leverage SOA	Leverage SOA Under-Levered	Leverage SOA Over-Levered
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individualism	(0.0002) 0.0001	(0.0003) 0.0031 ***	(0.0001) 0.0015 ***	(0.0000) −0.0006 ***	(0.0000) 0.0021 ***	(0.0001) 0.0021 ***	(0.0000) 0.0019 ***
Masculinity	(0.0002) −0.0014 ***	(0.0003) −0.0028 ***	(0.0000) −0.0018 ***	(0.0000) −0.0001 ***	(0.0000) 0.0004 ***	(0.0001) 0.0004 ***	(0.0000) 0.0004 ***
Uncertainty Avoidance	(0.0001) −0.0006 ***	(0.0002) 0.0005 ***	(0.0000) −0.0001 **	(0.0000) −0.0008 ***	(0.0000) 0.0004 ***	(0.0000) 0.0005 ***	(0.0000) −0.0004 ***
Long-term Orientation	(0.0001) 0.0003 ***	(0.0002) 0.0009 ***	(0.0000) 0.0015 ***	(0.0000) −0.0007 ***	(0.0000) −0.0011 ***	(0.0000) −0.0008 ***	(0.0000) −0.0016 ***
Indulgence	(0.0001) −0.0006 ***	(0.0002) −0.0020 ***	(0.0000) 0.0008 ***	(0.0000) −0.0000	(0.0000) −0.0005 ***	(0.0001) −0.0005 ***	(0.0000) −0.0007 ***
Observations	125,985	125,985	111,434	117,570	117,122	37,936	79,186
R-squared	0.0993	0.2515	0.8129	0.7473	0.8931	0.9223	0.9209

5. Conclusions

This study examined the relation between corruption and corporate debt policies, with a focus on its differential impact across different countries. Specifically, we investigated the impact of twin agency problems, namely political corruption and minority shareholders' expropriation, on leverage decisions.

First, we examined how corruption variables affect the level of debt. Our findings indicate that in more corrupt countries, management tends to shield liquid assets from potential political extraction by maintaining higher levels of leverage. Moreover, we observed that higher levels of minority shareholder protection (MSP) are further associated with higher levels of debt.

Subsequently, we explored whether the impact of twin agency problems varies based on legal origin and degree of economic development. Interestingly, we discovered that the impact of corruption on leverage is statistically significant solely in developed countries, while MSP and ownership concentration have a stronger impact on capital structure in developing countries. Next, we studied the impact of corruption and MSP on several dimensions of debt management, including the stability of capital structure, deviation from the optimal level of debt, and leverage speed of adjustment. The results show that twin agency problems indeed have a statistically significant effect on debt policies, including the degree of leverage, debt maturity, stability of capital structure, deviation from target, and leverage speed of adjustment. In summary, we demonstrated the overall significance of twin agency problems for firm financing policies in the international context.

While our analysis included a relatively large sample of firms and countries, it is important to acknowledge that some countries and firms were excluded due to limited or missing data. Thus, the results of the analysis should be interpreted accordingly. While we included a wide variety of control variables in our analysis based on previous research findings, we cannot exclude the possibility that there are some additional factors influencing leverage that have not been identified. Additionally, the findings represent aggregate results for all countries and firms included in our sample and are not necessarily representative of the relationship for any specific country. Future research can focus on country-specific and/or region-specific investigations.

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Data Availability Statement: All country-level data is from publicly available sources. Firm-level data is from Compustat Global available through Wharton Research Data Services (WRDS).

Conflicts of Interest: The authors declare no conflict of interest.

Notes

- ¹ Enterprise Surveys: www.enterprisesurveys.org (accessed on 17 January 2024), The World Bank Group (The Enterprise Analysis Unit of the World Bank Group 2014).
- ² Cultural dimension scores for various countries and detailed definitions for each cultural dimension are available from The Culture Factor Group at <https://www.hofstede-insights.com>.
- ³ The value of the variables that fall below the 1st percentile are set as equal to the 1st percentile, and the value of the variables that fall above the 99th percentile are set as equal to the 99th percentile.
- ⁴ *Control of Corruption*: Estimate measure is expressed in units of a standard normal distribution; as a result, it can range from approximately -2.5 to 2.5 . Thus, a higher score should be interpreted as stronger anti-corruption management and better governance.
- ⁵ The examples of studies that estimate leverage SOA using the partial adjustment model to include (Flannery and Rangan 2006; Faulkender et al. 2012; Öztekin and Flannery 2012; Flannery and Hankins 2013; Öztekin 2015; Orlova and Harper 2022), among others.
- ⁶ The optimal amount of leverage balances the cost and benefits of debt and has been shown to have positive impact on firm performance (e.g., Ahmed et al. 2023).

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Article

Forecasting Financial Investment Firms' Insolvencies Empowered with Enhanced Predictive Modeling

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Abstract: In the realm of financial decision-making, it is crucial to consider multiple factors, among which lies the pivotal concern of a firm's potential insolvency. Numerous insolvency prediction models utilize machine learning techniques try to solve this critical aspect. This paper aims to assess the financial performance of financial investment firms listed on the Iraq Stock Exchange (ISX) from 2012 to 2022. A Multi-Layer Perceptron predicting model with a parameter optimizer is proposed integrating an additional feature selection process. For this latter process, three methods are proposed and compared: Principal Component Analysis, correlation coefficient, and Particle Swarm Optimization. Through the fusion of financial ratios with machine learning, our model exhibits improved forecast accuracy and timeliness in predicting firms' insolvency. The highest accuracy model is the integrated MLP + PCA model, at 98.7%. The other models, MLP + PSO and MLP + CC, also exhibit strong performance, with 0.3% and 1.1% less accuracy, respectively, compared to the first model, indicating that the first model serves as a powerful predictive approach.

Keywords: insolvency; MLP; feature selection; financial ratio

1. Introduction

Insolvency forecasting (IF) seeks to determine the chances of a company becoming insolvent and therefore helps in evaluating its financial strength. IF includes models such as cash flow forecasts in which potential cash deficits can be detected and controlled, thus easing financial failure risks. Financial insolvency is associated with the terms failure, distress, bankruptcy, and default. This type of insolvency is regarded as an expensive event that affects a firm's ideal capital structure and leads to acts adverse to debt holders and stakeholders. However, financial insolvency can also improve corporate performance by encouraging changes and forcing managers to make riskier decisions (Almeida 2023).

Insolvency occurs when an entity's financial liabilities exceed its assets, resulting in an inability to pay debts as they become due. Therefore, insolvency is a critical financial condition that indicates a fundamental imbalance between what an entity owes and what it owns. Insolvency can manifest in different forms, such as cash-flow insolvency, where an entity lacks the necessary liquidity to meet its immediate payment obligations, or balance-sheet insolvency, where its total liabilities exceed the total value of its assets. Insolvency can have severe consequences, including legal actions by creditors, asset liquidation, debt restructuring negotiations, or the initiation of bankruptcy proceedings to address financial distress and facilitate a resolution of outstanding debts (Casey and Macey 2023).

Several insolvency risk statistical prediction schemes have been developed that have received significant attention from scholars and practitioners, such as the Z-score model (Pratiwi et al. 2023), the Zeta-score model (Vo 2023), and the logistic regression model (Gavurova et al. 2022). However, in the present complex business environment, managers have to determine the prospects of insolvency and act to prevent insolvency to ensure

solvency to avert probable business failure. This problem can also be solved by the new opportunities presented by machine learning and artificial intelligence for companies with large sets of data, as these approaches allow for analyzing the data and finding patterns and trends.

In a nutshell, IF mathematical models and AI-based approaches have some merits and demerits analogous to those of statistical models. These models are fed with fewer numbers of parameters, and they are capable of producing closer similarities in different datasets. Nevertheless, these models do not attempt to estimate the data structures, even though they are complicated. IF models developed on the use of AI are more complex in terms of learning capabilities; however, compared to the other models, they require more parameters, take longer to complete, and may lead to lower generality (Bassiouni et al. 2022).

The importance of this study is to address the gaps in several studies, including (Sharma et al. 2018), regarding some basic components, such as data pre-processing, parity of database distribution, and the effects of these in prediction, as depicted in Section 2. The disregard for these elements in prior research has resulted in the formulation of biased prediction models. To bridge these research gaps, we concentrate on feature selection methods to construct a precise model for early-stage financial insolvency prediction using genuine financial data from Iraqi enterprises. Our methodology also tackles data readiness, preprocessing, and data imbalance challenges.

This article introduces the enhanced forecasting model using Multi-Layer Perceptron (MLP). On the application and domain level, MLPs provide predictive power exhibiting strong forecasting skills in different financial forecasting tasks, such as stock price prediction, risk assessment, and portfolio optimization (Nayak et al. 2022). Nevertheless, understanding the constraints of these models is essential to ensure that predictions are not solely reliant on the most current techniques but are rooted in the most appropriate approach for the specific problem. With various types of ANNs showing promise in addressing financial forecasting challenges, this study concentrates on identifying the most effective models for forecasting insolvencies to attain optimal outcomes by using the hyper-parameter tuning method. The findings indicate that feature selection proves significantly advantageous for such tasks, resulting in reduced complexity relative to alternative models. Principal Component Analysis, Particle Swarm Optimization, and correlation coefficients are utilized for the feature selection step. The Synthetic Minority Oversampling Technique (SMOTE) assesses various parameter configurations and addresses imbalanced datasets. A case study compares techniques using a unique real dataset. The study critically evaluates the procedures and variations in outcomes. The combination of these advanced machine learning algorithms aims to improve the precision and effectiveness of financial distress prediction, allowing for early interventions and strategic decision-making.

The subsequent parts of the paper are organized in the following manner: The related literature is examined in Section 2. Section 3 introduces the proposed enhanced forecast insolvency model. The experimental study is thoroughly explained in Section 4. Section 5 delves into the results and discussion employed. The conclusion is presented in Section 6. Limitations and directions for future research are detailed in Section 7.

2. Related Works

Financial distress prediction is crucial in risk management, investment decisions, and corporate governance. This review provides a comprehensive overview of approaches, strategies, and variables used in predicting financial distress, including the importance of financial ratios. The evaluation examines empirical data on the effectiveness of these predictors across different industries and economic conditions.

Karas and Režňáková (2020) revealed that operating cash-flow ratios with short-term debts significantly influence financial distress in SMEs and are more effective than traditional profit-based ratios. A hybrid modeling approach, including classification and regression trees, logistic regression, and PCA, was used to analyze the financial data of 4350 SMEs. The third model demonstrated the highest AUC of 0.93 in the learning sample.

Advanced solutions, including oversampling techniques, cost-sensitive approaches (CBoost algorithm), and ensemble-based models (XGBS algorithm) for bankruptcy prediction, were illustrated in (Le 2021). The study in (Budianita et al. 2022) was concerned with the application of the C4.5 algorithm and Adaboost to predict financial distress companies. These algorithms were applied to five financial ratios from Altman's model to calculate the current ratio, total working capital to total assets, return on equity, return on assets, market value added, and asset turnover. This research examined 755 annual financial reports of firms listed on the Indonesia Stock Exchange during the period 2016–2019. The study's results showed that the integration of the C4 model with the Research and Technology University allowed the achievement of the objectives discussed in this paper. 5 and AdaBoost slightly outperformed this model in terms of accuracy in predicting financial distress at a threshold of $K = 10$ with an accuracy of 86. A total of 49% of participants accepted the completion of the survey questionnaires, the result achieved was that the C4.5 accuracy at $K = 8$ was 85.12%.

Performing financial distress prediction with a particular focus on imbalanced datasets was the main concern of (Safi et al. 2022); the authors proposed a metaheuristic optimization-based artificial neural network (MHOANN) with a cost-sensitivity fitness function. For fine-tuning the weights and biases of the artificial neural network (ANN) in the proposed work, PSO and CSO techniques were used. The evaluation of the method involved three datasets: all the variants of Spanish, Taiwanese and Polish. The level of accuracy obtained between the actual and prognosticated results differed across the datasets, thus the Spanish dataset yielded an accuracy ranging from 0.749 to 0.38 to 1.882, the UC dataset ranging from 0.789 to 0.888 and below, and the Polish dataset ranging from 0.790 to 0.848.

The authors (Yan et al. 2020) adopted Chinese manufacturing firms to model, analyze, and forecast earning management and financial distress. The authors examined the levels of association between financial ratios, macroeconomic factors, and the probability of financial failure. They employed financial performance indicators, such as net profit and net cash flow, in order to evaluate the effects of financial distress risk. It comprised a distributed Lagrange structure, logistic regression, and support vector machines (SVMs). In the process of feature selection, a Lasso penalty was applied. The lasso–logistic-distributed Lagrange (LLDL) model was the most effective, with an accuracy AUC of more than 95%, followed by the lasso–SVM-distributed Lagrange (LSVMDL) model, which had the greater G-mean and KS statistics. The two models also induced high levels of accuracy in predicting accounting ratios and macroeconomic variables.

The machine learning techniques used in (Shetty et al. 2022) for predicting bankruptcy were XGBoost, SVM, and deep learning neural networks. The following methods were used to predict bankruptcies with accounting data from the Belgian SMEs of the period 2002–2012 with accuracies of 82–83%.

The problems that arise from trying to forecast stock price movements using only historical data and from reiterating the need to account for factors such as news articles and social media activity were presented in (Maqbool et al. 2023). This work presented an intelligent system that involved Sentiment analysis programs (Valance Aware Dictionary and Sentiment Reasoner (VADER), TextBlob, Flair) and past data of stocks to predict the trends of the share market. The MLP Regressor model was used in forecasting the stock prices, where three kinds of sentiment scores were evaluated in their ability to predict the shifts in the tendencies of stock prices while testing the effectiveness of each sentiment analyzer on its own and along with other analyzers. Models with FLAIR (setting F), VADER joined with TextBlob (setting V + T), and F combined with T received the highest scores in trend predictions for the next day, which constituted 0.90. Moreover, the chosen single Flair sentiment analysis reached a high level of accuracy in the further prediction of the trend during the next 100 days (0.75).

The studies of Omari et al. (Al Omari et al. 2023) applied the ANN technique to evaluate insurance companies in the context of the Jordanian insurance industry. For this purpose, the researchers applied the multilayer perceptron (MLP) model with such input

predictors as subrogation, claims paid, market capitalization, and total shareholder equity. The refocusing on internal and external performance measurement involved analyses of the output variable, also known as total asset turnover (TAT). The findings obtained for this study revealed the fact that raising the number of iterations from 500 to 10,000 improved the ACC rate, precision rate, and F-score for the training dataset and the testing dataset. According to the 80% training sample, the ACC rate increased from 73%. From 7% at $n = 500$, the rate rose to 87%. From 8% at $n = 10,000$, the precision rate was raised from 56.8% to 79.63% and then decreased to 64%, while the F1-score increased from 57.9% to 70%. The same enhancements were also evidenced in the 20% test sample. Such findings asserted the flexibility improvement in the MLP model used in evaluating insurance companies' financial performance by exclusively using the total asset turnover (TAT) criterion.

The GALSTM-FDP model combined GA and LSTM, with LSTM standing for Financial Distress Prediction. This model made predictions with better accuracy compared to conventional models, such as Support Vector Machines (SVMs) and Decision Trees (DTs). The model was based on the data from 1953 firms of the MENA region and had a pureness of 50% to 91%. This work was a fusion of two methods, LSTM, which was exceptionally good at learning structures in financial time-series data, and GA, which was a form of optimization that mimicked the natural evolution process (Al Ali et al. 2023).

From the preceding information, it can be noted that little emphasis has been placed on cases addressing unbalanced datasets and other issues of preprocessing, which are arguably some of the most key factors that are capable of impacting the forecast performance model. Such a gap in the literature encourages more research and investigation in these directions. Our research contributes to filling this gap by investigating various feature selection approaches, addressing data preparation obstacles and preprocessing issues, and efficiently controlling data imbalance.

3. Materials and Methods

In this study, we integrate MLP and FS techniques to construct our Proposed Enhanced Model for Forecasting Insolvencies. The research methodology is shown in Figure 1.

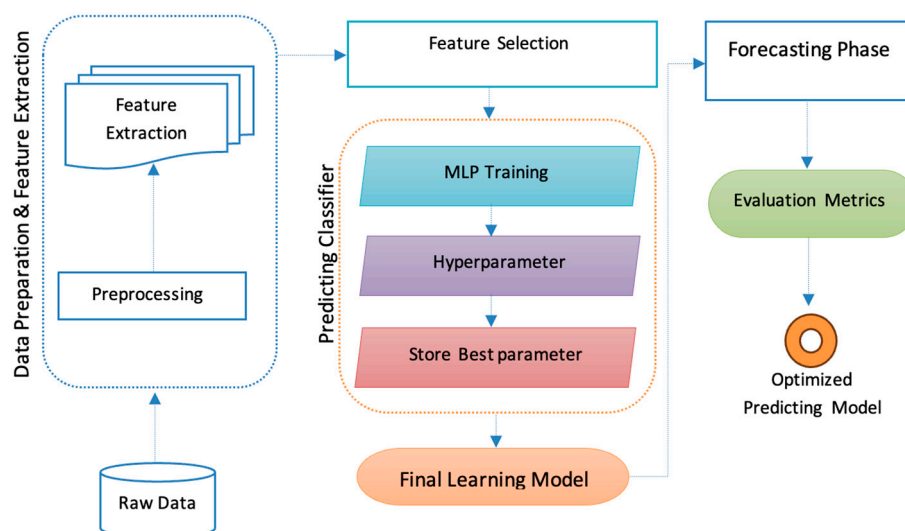


Figure 1. Proposed Enhanced Forecast Insolvency Model.

3.1. Data Preparation and Preprocessing

The datasets undergo cleaning and preprocessing to remove outliers and handle missing values to improve their quality using forward-filling by bringing forward the most recent observed value to fill in the gaps. The goal of this phase is to obtain purified data ready to be used in the next step.

To address the imbalanced issue in the dataset, the synthetic minority oversampling technique (SMOTE) is applied. The benefits of using the SMOTE include helping to balance the number of samples of different classes, which can, in turn, assist the classifier, especially in those that are affected by the class distribution. While random oversampling is somewhat similar to the duplication of records of the minority class, the SMOTE generates artificial records. This diversity is helpful in order to avoid overfitting the minority class during the model training process. The SMOTE's synthesis of new samples that have proximity to the existing minority class samples means that the classifier will be trained on a better and more discriminative decision surface, thereby enhancing generality. In the SMOTE, the parameter k , which controls the number of nearest neighbors used, is tunable, and it can be increased or decreased to make the generated synthetic samples closer or farther from other samples in the dataset, depending on the requirements. The SMOTE can be integrated with different types of ML models, such as decision trees, support vector machines, and neural networks; therefore, it is efficient in dealing with imbalanced datasets. Nevertheless, it is recommended to assess the accuracy of a model implemented after applying the SMOTE because, in some cases, it may not bring an improvement in the results according to the nature and characteristics of the data used. This technique works step by step as follows:

- Step 1. Identify the Minority Class: SMOTE starts by identifying which class in the dataset is the minority class (the one with fewer samples).
- Step 2. Choose a Sample: Randomly select an instance from the minority class.
- Step 3. Find the Nearest Neighbors:
 - For the selected instance, compute the distance to all other instances in the minority class. This is commonly done using a distance metric such as the Euclidean distance.
 - Identify the k nearest neighbors of an instance from the minority class.
- Step 4. Generate Synthetic Examples: For each of the k selected neighbors (X_n), create new synthetic instances:
 - Randomly select one of the k nearest neighbors.
 - Use the following formula to create a new synthetic instance X_{new} :

$$X_{new} = X_i + (I - X_i) \times \delta \quad (1)$$

where X_i is an element in K_{xi} : $X_i \in X_{min}$.

This finding suggests that the new instance X_{new} is created along the line segment between the original instance X_i and its selected neighbor X_n .

- Step 5. Repeat: Repeat the process until the desired number of synthetic instances is created for the minority class, effectively balancing the dataset.

3.2. Feature Extraction

The subsequent phase involves feature extraction. Extracted data are used to calculate 24 financial ratios that make up the features of the predicting model. The calculations of such financial ratios are shown in Table 1.

Table 1. Financial Ratios Formula.

Group	Financial Ratios	Calculation Formula	Ref.
Liquidity	Current Ratio (CR)	Total Current Assets/Total Liabilities	(Radovanovic and Haas 2023)
	Instant Liquidity Ratio (ILR)	Cash/Total Current Liabilities	(Zhao et al. 2024)
	Net Working Capital (NWC)	Current Assets–Current Liabilities	(Zhu et al. 2021)
	Equity Ratio (ER)	Equity/Total Liabilities	(González and Keddad 2024)
	Debt Ratio (DR)	Total Liabilities/Equity	(Chakri et al. 2023)
Activity	Accounts Receivable Turnover (ART)	Net Sales/Accounts Receivable	(Wang et al. 2023)
	Fixed Asset Turnover (FAT)	Net Sales/Net Fixed Assets	(Lee 2023)
Profitability	Net Profit (NP)	Net Profit/Sales	(Zhang et al. 2022)
	Return on Equity (ROE)	Net Profit/Equity	(Salah 2020)
	Return on Capital (ROC)	Net Operating Profit/Working Capital	(Anton and Nucu 2020)
	Return on Assets (ROA)	Net Profit/Total Assets	(Mattos and Shasha 2024)
	Return on Investment (ROI)	Net Profit/Total Assets	(Xu et al. 2022)
	Proportion of a Corporation's Assets (PA)	Cash/Total Assets	(Lohmann et al. 2022)
	Current Assets to Total Assets (CATA)	Current Assets/Total Assets	(Kim 2011)
	Total Current Liabilities (TCL)	Working Capital/Total Assets	(Wang et al. 2024)
	Working Capital Turnover (WCT)	Working Capital/Net Sales	(Kušter et al. 2023)
	Current Assets (NCA)	Net Profit/Current Assets	(Wu et al. 2022)
	Sales to Operating Profit (SOP)	Net Operating Profit/Net Sales	(Sang 2020)
	Asset Turnover (AT)	Net Sales/Total Assets	(Lin and Bai 2022)
	Sale to Current Assets (SCA)	Net Sales/Current Assets	(Kušter et al. 2023)
	Days' Sale Uncollected (DSU)	$(365 \times \text{Accounts Receivable})/\text{Net Sales}$	(Jadiyappa and Shette 2024)
	Accounts Receivable (AR)	Accounts Receivable/Total Liabilities	(Tarjo et al. 2023)
	Operating Return on Assets (OROA)	Net Operating Profit/Total Assets	(Lee 2023)
	Sale to Current Assets (SCA)	Current Assets/Net Sales	(Laitinen et al. 2023)

These ratios, when applied, assist investors in analyzing the profitability of the investment firm and comparing it with other firms in the industry to identify potential risks or opportunities.

Liquidity ratios are important in finance since they point out the ability of the company to meet its current liabilities. Some key reasons why liquidity ratios are important are as follows. Liquidity shows the capacity to meet current obligations, which are important for the company's operations. Liquidity ratios, therefore, help investors and creditors evaluate the risk of investing in or financing the business. A low liquidity ratio may cause problems in the company's financial status; the firm may be unable to pay its debts. It may show how effectively a firm has been able to manage existing stocks of inventory, the amount of account receivables, and the accounts that are payable. A company that has a favorable liquidity status can participate in different opportunities that come up without having to look for financing. Lenders use liquidity ratios in an attempt to determine a company's capability of repaying loans. Comparatively higher liquidity ratios may help in obtaining better terms in borrowings and hence lower interest rates. Liquidity ratios help an investor

and analyst of a particular firm evaluate how the firm is doing in comparison to other firms and its relevant industry (Zhao et al. 2024).

Turnover ratios, also referred to as activity ratios, are relevant in financial investment as they determine the efficiency of a company in utilizing its assets to generate revenues or cash flows. These ratios assist the investors in gaining insight into how efficient a company is in its operations. A higher turnover rate is often perceived to be an indicator of the good performance and efficient utilization of assets, improving the overall economic value of a business and hence the appeal to investors (Wang et al. 2023).

Profitability ratios are key financial indicators that are essential in everyday usage by investors and analysts while assessing the overall performance of a business in generating the net income relative to the total amount of sales, the total amounts of tangible and intangible assets, and the shareholder funds, respectively. These indicators can influence it in different ways. 1. one of these ways is performance appraisal. Therefore, profitability ratios, such as net profit margin, return on assets (ROA), and return on equity (ROE), help the investor to determine whether or not the firm is earning the best profit based on its revenues and investments. 2. From the profitability ratios, the investors who make investment decisions are in a position to compare firms that are in the same industries. Better forecasting is achieved through ratios, which may imply that higher ratios indicate that the firm is in a better financial position regarding operational efficiency, thereby facilitating investment decisions. 3. Based on investor attraction, such a firm may have very high levels of profitability, and there may be the possibility that such firms can easily expand in the future. Conversely, low ratios indicate inefficiency in operations, which may, in one way or the other, jeopardize the future growth of the company. 4. Regarding financial solvency, it is possible for investors to evaluate financial solvency by the use of ratios including ROE and ROA. This is especially because firms that have proved to be profitable over a certain period of time are usually less risky, particularly when it comes to investment during an economic crisis (Kim 2011).

3.3. Feature Selection Techniques

The selection of subset features plays a crucial role in optimizing the performance of a model. By avoiding the curse of dimensionality, this processing step simplifies the model, making it more interpretable, timely, and efficient for prediction, thereby mitigating the risk of overfitting. In this phase, we compare the impacts of three of the most distinct feature selection methods, namely PCA, the correlation coefficient, and PSO, on the performance of the proposed model in terms of the subset generated and the time of training.

3.3.1. Principal Component Analysis (PCA)

PCA is another method in data preprocessing and is a dimensionality reduction technique that can also be employed in carrying out feature selection by determining the best features within a dataset. The basic steps of this method for feature selection are as follows:

- Step 1: Standardize the Data.
- Step 2: Calculate the Covariance Matrix.
- Step 3: Calculate the Eigenvalues and Eigenvectors.
- Step 4: Sort Eigenvalues and Eigenvectors.
- Step 5: Select Principal Components.
- Step 6: Transform the Original Data.
- Step 7: Analyze the Principal Components.
- Step 8: Select the Features.

Therefore, by following the steps mentioned above, PCA can be applied to feature selection and dimensionality reduction for several problems, particularly for high-dimensional problems.

3.3.2. Correlation Coefficient

The correlation coefficient is one of the statistical measures used to quantify feature space, and it is normally used in feature selection. With the aid of CC, one is able to establish the magnitude and the directions of linear relationship between two variables. Its values fall between -1 and 1 .

$$CC = \begin{cases} 1 \Rightarrow a \text{ perfect positive linear relationship.} \\ -1 \Rightarrow a \text{ perfect negative linear relationship.} \\ 0 \Rightarrow no \text{ linear relationship.} \end{cases}$$

3.3.3. Practical Swarm Optimization-Based Feature Selection (PSO-FS)

PSO is a genetic algorithm that originated from the population and was developed by Kennedy and Eberhart in 1997 (Kennedy and Eberhart 1997). PSO, on the one hand, employs an iterative and iterative process that is modeled on a flock of birds for the attainment of the best solution. The basic steps of the PSO algorithm present are as follows.

3.4. Multi-Layer Perceptron (MLP)

This phase involves training and optimizing the predicting classifier. The MLP model is proposed, which is one of AI's most popular and simple forms for NN, and it has broken through in the area of financial forecasting and several other fields for multiple reasons, such as its nonlinearity property. This property suits our case since the variables of financial data usually show complex nonlinear relationships between them. MLPs, being nonlinear function learners, can successfully model these relationships. A second advantage of MLP is its ability to provide time series analysis. MLPs can be tailored to deal with time series data and to take into account the temporal dependencies and trends occurring in the financial market (Yi et al. 2023). However, it is important to note that MLPs also have limitations, such as overfitting, especially with a smaller amount of data. Therefore, the application of cross-validation is essential to prevent model overfitting.

The MLP model consists of one input layer with 24 input neurons, one or multiple hidden layers, and one output layer. The number of nodes in the output layer should match the number of classes in our multi-label problem, so the output layer for our problem has 2 nodes. With the help of backpropagation algorithms, these multilayer networks are trained using the 80% training set via a supervised method where the error in the output layer is computed first. Then, the weights in the preceding layers are adjusted through a backward iterative process.

3.5. Evaluation Metrics

In the improved methodology of the proposed model, the evaluation phase plays a crucial role since it helps in the assessment of the performance and the quality of the built machine learning model. During this phase, the objective is to see how well the models in question are able to and, more particularly, how accurate they are in terms of the forecasts produced. To this end, during the initial splitting of the dataset, 20 percent of the samples are allocated for test purposes. This test is carried out to test the models on data not included in the model development process. By utilizing this particular set of test data, it is possible to achieve a fair assessment of all of the models in terms of their predictive accuracy and performance when the new data extend beyond the current training dataset.

As part of the evaluation of the developed models, the current work focuses on a binary classification task and uses confusion matrices in the process of assessing all the developed models. Based on the confusion matrix, we can compute different measures of the performance of a given model. The selected measures are accuracy, precision, recall, F1-score, Jaccard, timing, and AUC.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (2)$$

$$Precision = \frac{TP}{TP + FP} \quad (3)$$

$$Recall = \frac{TP}{TP + FN} \quad (4)$$

$$F1 - Score = \frac{2 * Precision * Recall}{Precision + Recall} \quad (5)$$

$$Jaccard = \frac{TP}{TP + FP + FN} \quad (6)$$

4. Experimental Study

4.1. Dataset Description

In this section, we deal with the original dataset. The financial investment firms chosen for this study are listed on the ISX. The sampling period is from 2012 to 2022, which is equal to 10 years. These firms are analyzed and distinguished based on reports from the auditing, financial, and taxation databases and the ISX. All the variables used in the sample are obtained from standard financial reports, including income statements and balance sheets. Thus, the usefulness of this study is not limited by the fact that only Iraqi firm data are employed.

Our empirical results include 1440 instances for six firms, with 240 attributes allocated to each firm over 10 years, forming the basis for the experiments conducted. The dataset is split into 80% for training purposes and 20% for testing purposes. The dataset constitutes two categories: financial insolvency (coded as 1) and non-insolvency (coded as 0), depending on whether the firm is marked as insolvent (D or G) or not (S). This categorization is based on Altman's technique, as seen in Table 2.

Table 2. Description of Our Dataset Categories Based on Altman's Independent Variables.

Classify	Frequency	Percent
1 (D or G)	38	32.1
0 (S)	18	67.9
Total	56	100

The feature set comprises 24 distinct financial ratios, with the indicators (liquidity, activity, profitability, and efficiency), listed in Table 1. Feature selection is crucial in the process of machine learning since it enables us to remove features that cause overfitting, increases model understanding, increases accuracy, and decreases learning time. Reducing the dimension of the input data assists in making models more ordered and faster at making predictors, especially when time is important in training. The process then uses oversampling as a technique to help balance classes before the conventional model training process begins. As a result of such replication, oversampling offsets the dominating scale and enforces algorithms to consider otherwise marginalized yet essential classes.

4.2. MLP Configurations

Various configurations of MLPs for predicting insolvency are investigated, involving optimization techniques, activation functions, neuron quantities, and layer quantities, each with different levels of tolerance, which are necessary to create a successful neural network model. Nonetheless, since finding the best MLP structure is a difficult undertaking that is dependent on the quality of the data and the complexity of the issue, it is crucial to tune the model parameters. The parameter search space is listed in Table 2, which represents the minimum number of design decisions that an automated system must make for a given

learning problem. Our experiments for model tuning address each of the parameter choices in Table 3.

Table 3. Proposed Insolvency Prediction Model Search Space.

Optimization Model	Adam	sgd							
Hidden Layer Sizes	10	20	30	33	50	55	70	80	100
Activation Function	ReLU	Logistic	Tanh	identity					
Alpha	0.07	0.1	0.5	0.7	0.0001	0.001	0.01	0.3	0.2
Learning Rate	Constant	Adaptive	0.001						

To assess the performance of our proposed methods, we conduct the following four experiments:

- (A) Evaluating the classical MLP classifier without any preprocessing or feature selection optimization processes.
- (B) Evaluating the optimized model version using data preprocessing (DP) that addresses curing missing values and imbalanced datasets (MLP + DP).
- (C) Evaluating the optimized simplified model version using additional feature selection for reducing the model complexity, data volume, and execution time (MLP + DP + FS). The experiment compares 3 different techniques for FS, which are PCA, CC, and PSO.
- (D) Evaluating a finally optimized fine-tuned version of the predicting model in (C), by tuning and optimizing the classifier hyperparameters.

5. Results and Discussion

This section presents the experiments illustrated in the previous section. Moreover, this section compares and evaluates results obtained by conducting a set of extensive experiments using the five evaluation metrics outlined at the end of Section 4.

Table 4 shows the performance results of the classical MLP classifier without any optimization processes (Experiment A). The table shows that the classical MLP without optimization is average, with a 0.857% precision, 0.667% recall, 0.748% F1-score, 0.667% accuracy, and 0.778% AUC. The training time is expected to take an excessively long duration due to the lack of efficient optimization algorithms, such as gradient descent and backpropagation, leading to slow learning, convergence, and possibly overfitting. The model achieves a processing time of 3:4 (Minute:Second) and uses all feature space.

Table 4. Results of Metrics of Classical MLP Classifiers Without Optimization Processes.

Model	Precision	Recall	F1-Score	Accuracy	Jaccard	AUC
MLP	85.7	66.7	74.8	66.7	69.21	77.8

Experiment B studies the effect of data preprocessing (DP) to address missing values and imbalanced datasets. The preprocessing steps in this experiment ensure data consistency and tackle the imbalance issue through the SMOTE, as illustrated by Figure 2.

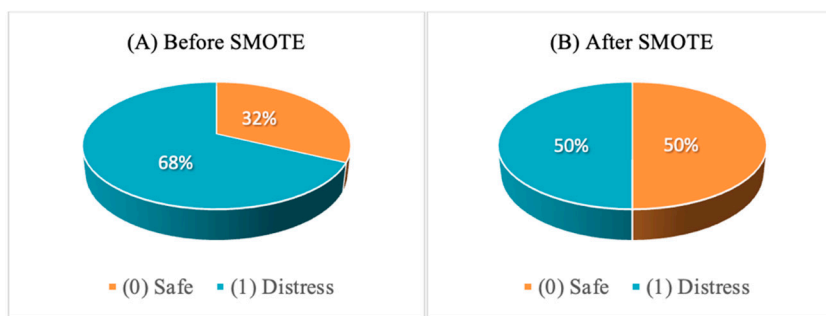


Figure 2. Application of SMOTE to an Imbalanced Dataset.

The Figure shows Pie charts comparing the numbers of instances labeled “Safe” and “Distress” before and after using a method called SMOTE. Before applying the SMOTE, 68% are “Safe” and 32% are “Distress”, while after applying the SMOTE, the percentages of “Safe” and “Distress” instances both become 50%. Table 5 shows the results of this experiment, in which the performance of MLPs is enhanced by 1.9% for precision, 9.8% for recall, 1.4% for F1-score, 0.9% for accuracy, and 2.9% for AUC.

Table 5. Results of Metrics of MLP + DP.

Model	Precision	Recall	F1-Score	Accuracy	Jaccard	AUC
MLP	87.6	67.5	76.2	67.6	70.39	80.7

Nonetheless, Experiment C carries out additional improvement experiments to achieve a more accurate and less complex model. In Experiment C, the effects of integrating FS processes are investigated. The 3 FS methods, Principal Component Analysis (PCA), Particle Swarm Optimization (PSO), and correlation coefficients are compared.

Integrating FS results in a decrease in the number of features by selecting relevant features, thereby reducing the model’s complexity and avoiding overfitting. Applying PCA has led to easier visualization and interpretation of data, reduced computational complexity and training time of machine learning models, and the removal of noise and irrelevant features (Figure 3).

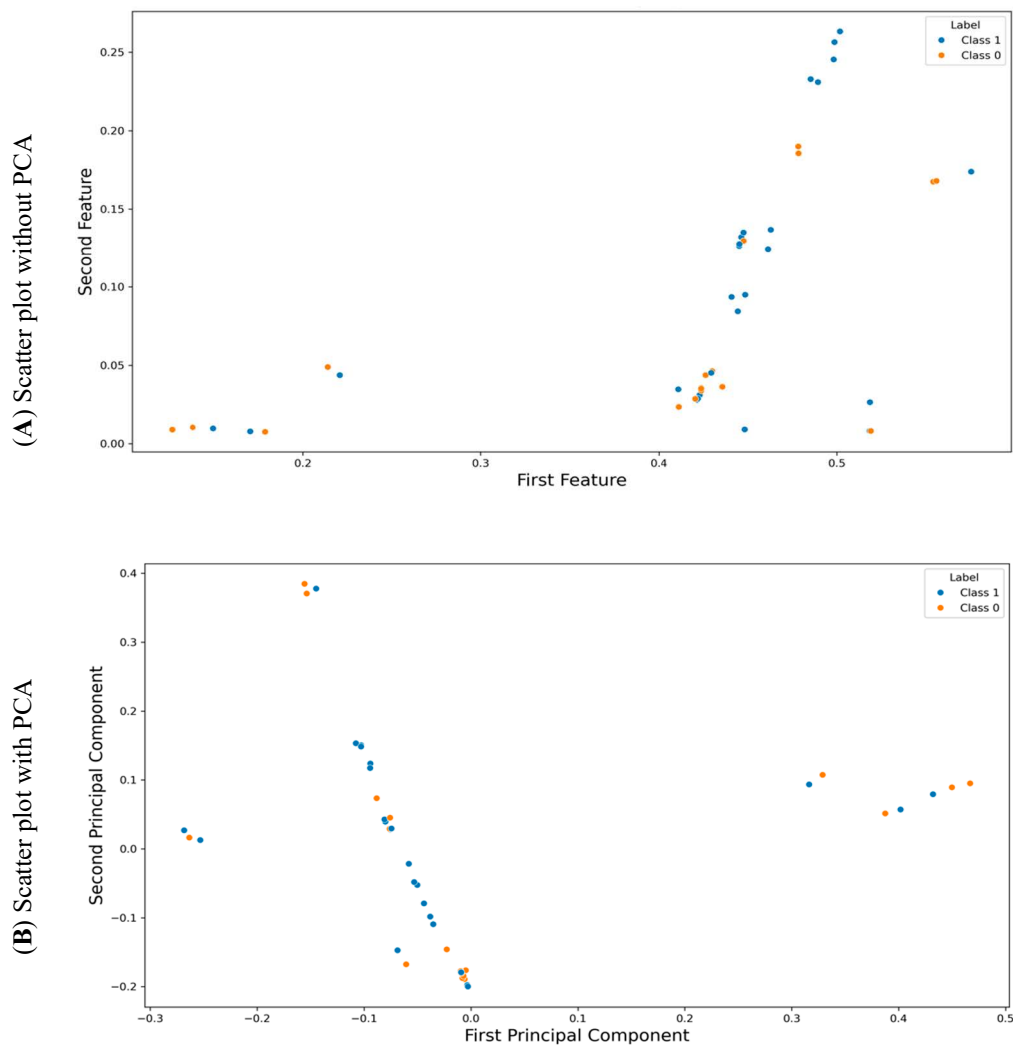


Figure 3. Scatter Plot Without/With PCA.

Determining the optimal number of PCs to retain dimensionality reduction is a crucial challenge in conducting PCA. In our data, the number of PCs is 6, as Figure 4 shows. To facilitate this decision-making process, it is helpful to evaluate an important parameter, which is the variance ratio. This ratio quantifies the proportion of variance explained by each PC. By visualizing this information on a scree plot, researchers can pinpoint the elbow point, as illustrated in Figure 5. From the most significant to the least significant principal component, the graphic shows the explained variance for each one. The plot's “elbow” designates the beginning of the curve’s flattening. The number of major components that have to be kept for additional examination is indicated by this point. The “elbow” appears to consist of two or three parts in this figure. The cumulative explained variance, represented by the red line, indicates the percentage of the overall variance that can be attributed to the first n components.

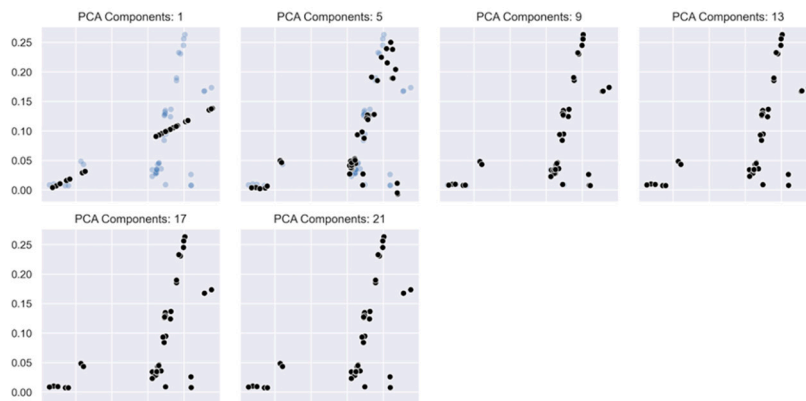


Figure 4. Optimal Number of PCs.

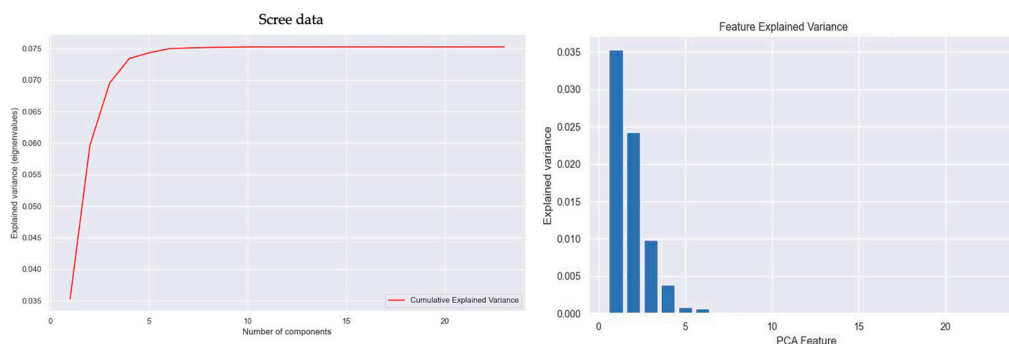


Figure 5. Scree Plot.

Figure 5 presents an explained variance of the principal components in PCA. X-Axis (Number of Components): On the horizontal axis, we have taken the number of the principal components from 1 to 20. Y-Axis (Explained Variance): The vertical axis illustrates the degree of explained variance or the eigenvalues of the principal components conveying how much of the variation in the dataset is retained by each of the principal components. Bar Chart: The blue bars are the explained variance for each of the principal components shown. The first few components (1 to 5) account for the majority of the data's variance, unlike the remaining components. Cumulative Explained Variance: The first horizontal line in red indicates the Cumulative Explained Variance, which depicts the total variance that has been explained as more components are included. Initially, there is an upward trend, which demonstrates that the first few components contribute significantly towards the total variation. Elbow Point: The graph indicates an 'elbow point' around the first few components, where an increase in the number of components accounts for less and less variation in variance. Again, they indicate that beyond a certain number of components, the united explained variance rises but only by a negligible margin thus implying that additional components are less influential in explaining variance.

This finding suggests that a small set, probably including only the first 5 components, accounts for most of the data variability. This result implies that it is possible to perform dimensionality reduction by only retaining such components, making the model simpler with the right amount of detail required.

An additional parameter to consider is the cumulative explained variance. This statistic sums the explained variance ratios to a certain PC. One can choose PCs that exceed a specific threshold, such as 80% or 90%.

Figure 6 is a line graph that shows the link between cumulative variance and the number of components. The goal of this graph is to determine the optimal number of components for capturing the majority of the data's volatility. As shown in the figure, the curve at the first stage increases at a sharper angle, which means that the initial components account for a large extent of the variance. At some point, the last part of the

curve starts making flat progress, signifying that subsequent components contribute to a less proportionate variation in the total variance. A dotted straight line drawn across the graph represents the 95% variability cumulative, which leads to extreme termination. The graph indicates that a certain amount of parts is needed to achieve this level, and the further addition of parts leads to a decrease in the contribution rate of variance. Finally, one's experience in the field and the analytical aims impact the decision of which PCs to maintain. When considering the number of selected features and execution time, the MLP + PCA model achieves a processing time of 1.57:1569.80 and a feature space reduction of 10–20%.

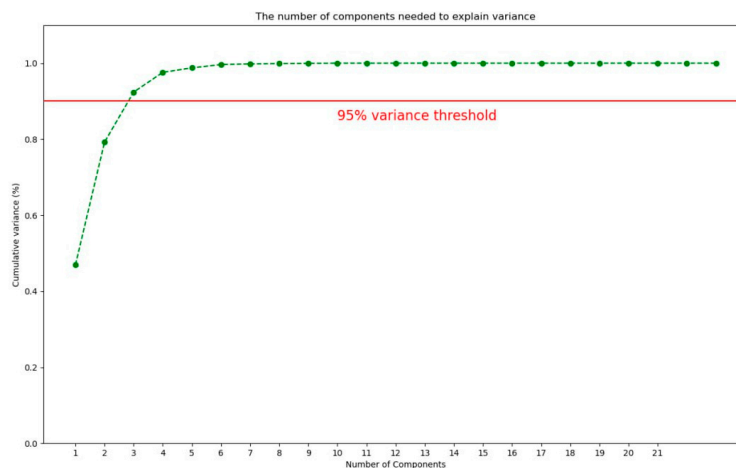


Figure 6. Number of Components Needed to Explain Variance.

The green line in the graph represents the cumulative explained variance as a function of the number of components. Each point on the line corresponds to the total variance explained by the components. As the number of components increased, the cumulative explained variance approached 1 (or 100%), indicating that more components accounted for more total variance in the dataset. The curve shows that the initial components contribute significantly to the explained variance, whereas additional components contribute less as the curve levels off. This visualization helps to understand how many components are needed to achieve the desired level of explained variance, such as the 95% threshold indicated by the red line.

The second FS employed is PSO. Global optimization contributes to the discovery of optimal solutions for intricate issues, refining parameter adjustments and hastening the convergence of machine learning algorithms. This process enables the tackling of nonlinear and multi-modal optimization challenges, thereby boosting model precision. Table 6 illustrates the 8 chosen features by PSO from the original set of 24:

Through this method, the features decrease from 24 to just 8, a reduction of 67%. When considering the number of selected features and execution time, the MLP + PSO model outperforms the MLP + PCA and MLP + CC models due to its shorter processing time of 1.05:1046.33 compared to 1.57:1569.80 and 1.16:1157.08, respectively. This difference results in a time discrepancy of 0.52:523.47 and 0.11:110.75, respectively, and a feature space reduction of 67%

The final FS employed is the correlation coefficient, which is a statistical metric indicating the strength of a linear relationship between two variables. The value ranges from -1 (inverse connection) to 1 (direct connection). A coefficient of 0 means no linear relationship, as shown in Figure 6.

Figure 7 depicts a correlation matrix obtained through the statistical analysis of financial data. The matrix depicts the correlation coefficients between several financial variables, which are represented by the rows and columns. Each cell in the matrix displays the correlation coefficient between the two variables assigned to that row and column. Positive values imply a positive correlation, whilst negative values suggest a negative correlation.

The color intensity reflects the size of the association. The diagonal cells always carry the value 1, which represents a variable's perfect correlation with itself. The color gradient illustrates the intensities of the relationships. Strong positive correlations, for example, are shown in deep blue, whereas strong negative correlations are depicted in dark red.

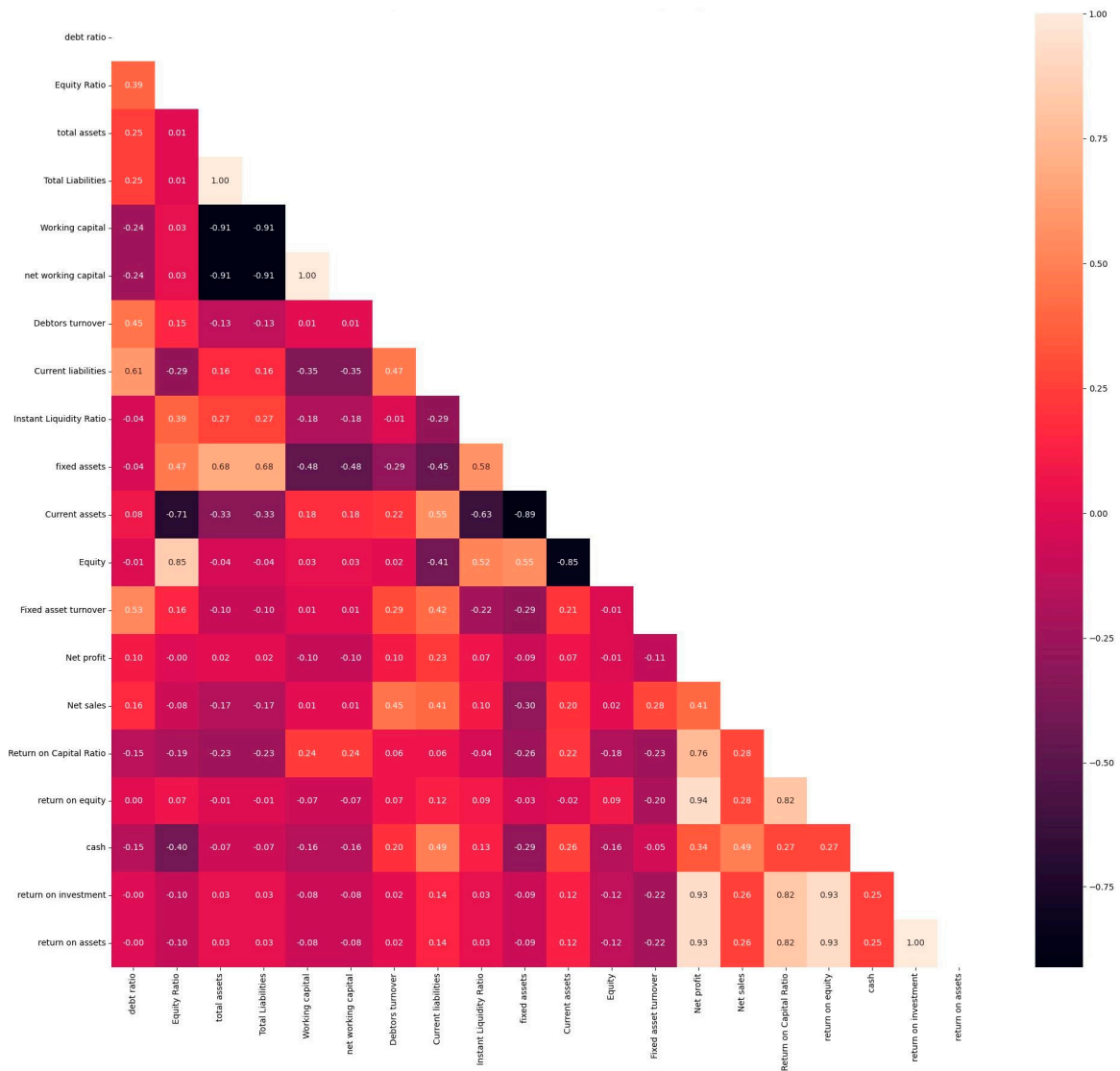


Figure 7. Correlation Heatmap of 10 Important Features With the Target.

Table 6. Selected Features Using PSO.

No. of Feature	Feature Index	Feature Name
1	0	Current Assets
2	8	Net Operating Profit
3	11	Working Capital
5	12	Current Ratio
6	13	Net Working Capital
7	14	Debtors' Turnover
8	20	Instant Liquidity Ratio

Figure 8 illustrates the absolute values of the correlation coefficients between features and the predictive values of the top 10 features: current ratio, net working capital, working capital, cash, net profit, current liabilities, return on equity, return on assets, return on investment, and accounts receivable. When considering the number of selected features and execution time, the MLP + CC model achieves a processing time of 1.16:1157.08 and a feature space reduction of 58.3%.

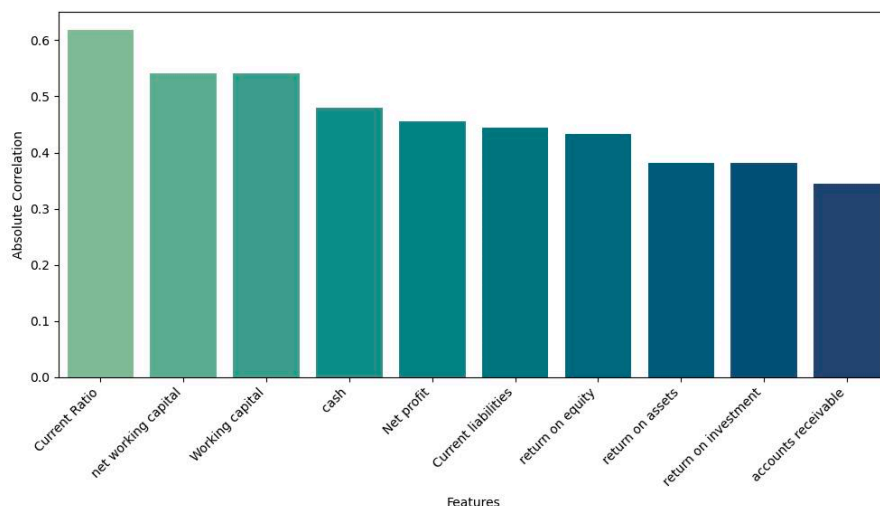


Figure 8. Highest Absolute Correlation Value of 10 Important Features.

In the first row of Table 7 with PCA-FS, the model shows enhancements of 1.4% for precision, 8.5% for recall, 5.8% for F1-score, 1.8% for accuracy, and 1.1% for AUC. In the second row of Table 7 using CC_FS, the model is boosted by 3.2% for precision, 2.6% for recall, 1.2% for F1-score, 1.8% for accuracy, and 1.9% for AUC. In the third row of Table 7 with PSO_FS, the model shows improvements of 0.006% for precision, 2.8% for recall, 1.5% for F1-score, 2.7% for accuracy, and 1.5% for AUC. When considering the number of selected features and execution time, the MLP + CC model achieves a processing time of 1.16:1157.08 and a feature space reduction of 58.3%.

Table 7. Results of Metrics for MLP + DP + FS.

Models + FS	Precision	Recall	F1	Accuracy	Jaccard	AUC
MLP + PCA	89	76	82	86	79.5	92.1
MLP + CC	84.4	93.1	88.5	86	87.7	99.3
MLP + PSO	87	95.6	91.6	95	91.9	95.5

The final Experiment D is the final fine-tuning step for the hyperparameters of the model achieved in Experiment C. Phase one of the popular techniques for hyperparameter tuning is using a random search algorithm. Random search is a simple yet effective method that involves randomly selecting hyperparameter values within a predefined range and evaluating the model performance with each set of values. In the beginning, the Hyperparameter Space is defined (Table 3 in Section 4). The optimal hyper-parameter discovered through the random search algorithm is demonstrated in Table 8.

Table 8. Optimal Hyperparameter Found by PCA, CC, and PSO.

Parameters	PCA	CC	PSO
Optimization Model	Adam	Adam	Adam
Hidden Layer Sizes	100	50	50
Activation Function	Identity	Identity	Identity
Alpha	0.7	0.001	0.001
Learning Rate	Adaptive	Constant	Adaptive
Elapsed Time [min:s:ms]	0:1.57:1569.80	0:1.16:1157.08	0:1.05:1046.33

In this study, many epochs are tested in the range of (3–100), and after many attempts, epoch 5 is selected, at which the best results are achieved in the shortest implementation time. Table 8 summarizes the estimators that achieved the best performance of these models. Essentially, the different combinations of activation functions, optimization algorithms, and architectures can cause the MLP to perform differently. The use of different metrics can provide insights into the strengths of each model. As mentioned in Table 3, different activation functions, 10 hidden layer sizes, 10 alpha values, and various learning rates and optimization algorithms are used to train and test the models. For all models, it is observed that the “Identity” function is the activation function that performs better when applied to our dataset. In our opinion, the model parameters depend on and are affected by the nature of the dataset. By the RandomizedSearchCV function in scikit-learn, the search is done over a predetermined range of hyperparameters. This method is efficient since it allows you to sample a predetermined number of hyperparameter combinations from specified distributions, especially in large search areas. The model, hyperparameter distribution, and search iteration count are all specified. You can assess the optimal parameters once the model has been fitted.

In the analysis of Table 9, it is observed that the diagnostic metrics of the models that achieve better performance are obtained using the Adam optimization algorithm. The second and third columns of Table 9 show the precision and recall rates of all models, respectively. The fourth, fifth, and sixth columns illustrate the F1, accuracy, and AUC rates, respectively. The model with the highest accuracy is the first MLP + PCA model with a value of 0.987, followed by the MLP + PSO and MLP + CC models with values of 0.983 and 0.976, respectively. On the other side, note that the second model (MLP + PSO) requires less time than other models at 1.05:1046.33, compared to the processing time of MLP + PCA and MLP + CC models at 1.57:1569.80 and 1.16:1157.08, respectively. Furthermore, only eight features, as a subset of the original set of 24 features, are employed in the MLP + PSO model.

Table 9. Results of Metrics for MLP + DP + FS (Fine-Tuning Version).

Model + FS	Precision	Recall	F1	Accuracy	Jaccard	AUC
MLP + PCA	99.9	99.9	99.8	98.7	96.5	99.9
MLP + CC	99.8	96.6	98.2	97.6	93.7	99.3
MLP + PSO	99.7	96.6	98.2	98.3	94.9	99.5

An essential tool for assessing and forecasting financial insolvency models is a confusion matrix. It offers a methodical approach for evaluating the prediction power of the model and comprehending the effects of various kinds of mistakes. For financial institutions and other stakeholders that depend on precise forecasts to make well-informed decisions, this assessment is essential. Figure 9 presents the confusion matrix of all the proposed models.

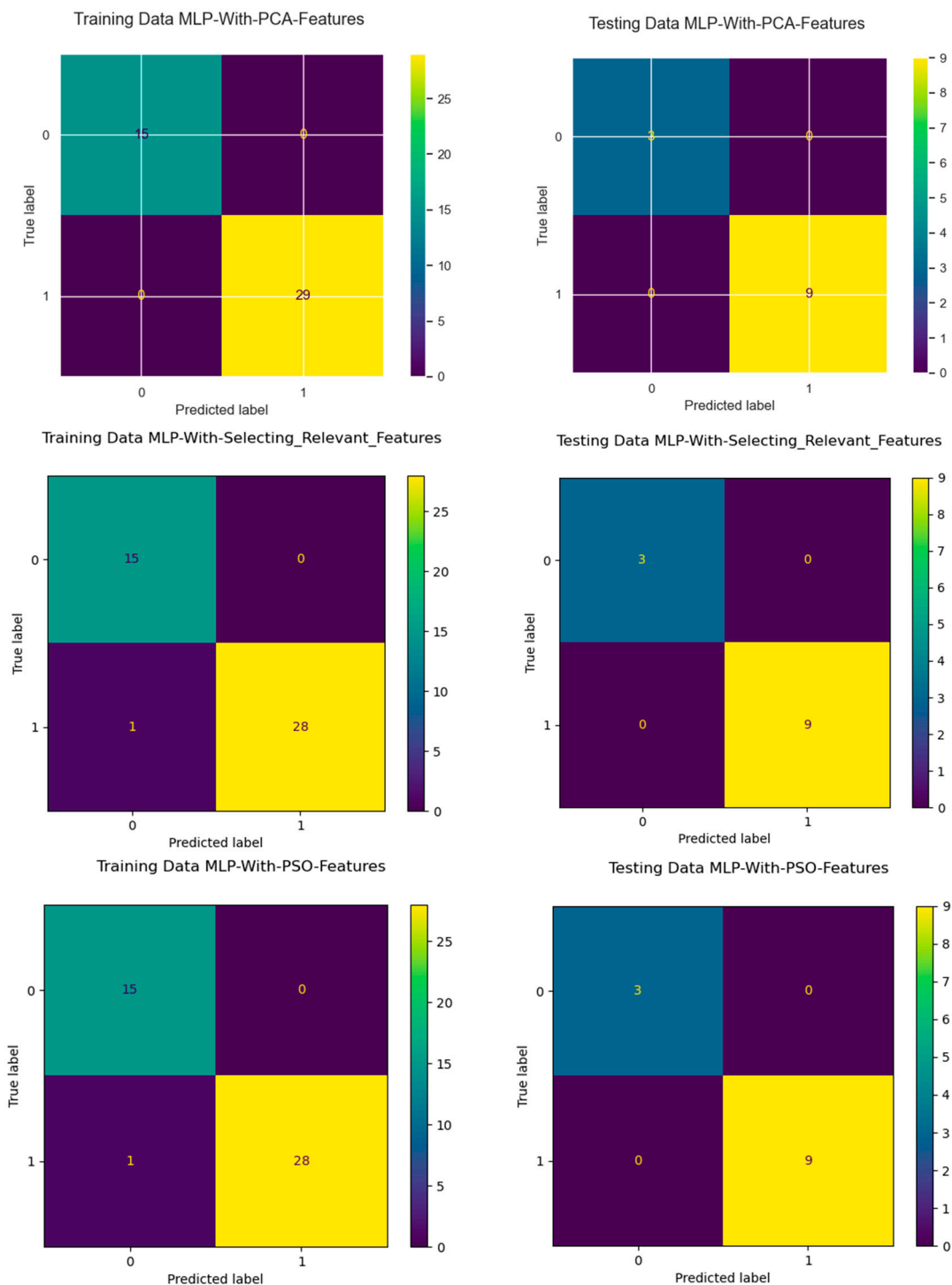


Figure 9. Confusion Matrix of Training and Testing Data Using PCA, CC, and PSO.

Figure 9 shows that the model is performing quite well, with a high number of true positives and true negatives, very few false negatives, and no false positives. This result indicates a high sensitivity (or recall) for class 1, meaning the model is good at identifying class 1 instances. The absence of false positives suggests perfect precision for class 0, meaning that when the model predicts class 0, it is always correct. In general, the three proposed models achieve excellent performance. The difference between these models is approximately 1%. Our proposed models are compared to existing works from literature. Table 10 illustrates this comparison.

Table 10. Comparison Summary of Related Work and Proposed Models.

References & Years	Methodology	Dataset	FN	FS	HID	HPO	ACC
(Karas and Režňáková 2020)	RT & LR	Czech	15	×	×	×	93
(Le 2021)	XGBS	Korean	19	×	✓	×	82
(Budianita et al. 2022)	C4.5 + Adaboost	Indonesia	21	×	×	×	86
(Safi et al. 2022)	MHO-ANN	Spanish, Tawan, and Polish	36, 94, 64	×	×	✓	88
(Yan et al. 2020)	LLDL and LSVMDL	Chinese	27	✓	×	×	95
(Shetty et al. 2022)	XGBoost, SVM and NN	Belgian	4	×	×	×	83
(Maqbool et al. 2023)	MLP	Yahoo Finance	-	×	×	×	90
(Al Omari et al. 2023)	MLP	Jordanian	195	×	×	×	84
(Al Ali et al. 2023)	GALSTM	Osiris	31	×	×	✓	92
Proposed Models	MLP + PCA	Iraqi	20	✓	✓	✓	98.7
	MLP + CC		10	✓	✓	✓	97.6
	MLP + PSO		8	✓	✓	✓	98.3

Note: ACC (Accuracy), Number of Features (FN), Feature Selection (FS), Handling Imbalanced Dataset (HID), Hyperparameter Optimization (HPO), × (do not use), ✓ (use).

Table 10 lists a comparison of the proposed work concerning existing work. Though it is not for comparison because of the different datasets employed in different works, it displays the recent state of the art of the related works. The above table elaborates on the advantages of the three of our suggested models in terms of the Number of Features (FN), feature selection (FS), Handling Imbalanced Dataset (HID), Hyperparameter Optimization (HPO), and performance accuracy. The accuracy of our proposed model shows an increase of roughly 5–16% compared to related works. The suggested model also has another benefit of having fewer features due to the usage of FS, which utilizes a limited number (20, 10, 8 features) yet outperforms the others, thus reducing execution time. On the other side, we find it interesting to clarify the differences between investment firms and industrial/commercial firms in various aspects, particularly in terms of working capital, cash flows, and revenue sources:

- **Working Capital:** Working capital is, more often than not, a major requisite essential to facilitate business transactions in industrial and commercial firms. This factor includes the cost of stock, accounts receivable, and accounts payable. On the other hand, investment firms may work with lower working capital due to the fact that they mainly deal with financial securities, not blocked assets, in terms of inventory and receivables. Firms' working capital, for the most part, relates primarily to cash flow requirements in trading operations.
- **Cash Flows:** The nature of the cash flows in these two types of firms is different. Industrial/commercial firms are involved in generating cash flows through revenue from their produced products and/or implementation of some services, so they can be relatively more consistent but unpredictable depending on the market forces. Investment firms, on the other hand, obtain cash flows through fees, commissions, and investment income. These aspects can be a lot more unpredictable and sensitive to market forces, investment returns, and clients' workflow.
- **Revenue Sources:** Industrial and commercial organizations generate their revenues through manufacturing sales and service provision, whereas investment firms obtain their revenues through asset management fees, transaction fees, interest, and

dividends on their investment portfolios. This has the effect of making their revenue functions more sensitive to the conditions of financial markets and, hence, vulnerable.

6. Conclusions

This research addresses a significant gap in previous studies that have not adequately emphasized pre-processing issues, the uneven distribution of databases, and the enhancement of predictive models in terms of financial insolvency prediction. Our proposed models tackle these gaps by processing the data and addressing the problem of class imbalance using SMOTE for improved model performance, reduced bias, increased generalization capabilities, and refined decision boundaries. For achieving a further optimized predictive model, feature selection is integrated.

Our proposed model is based on integrating an MLP with feature selection. Three techniques (PCA, CC, and PSO) are proposed for ultimately simplifying the model and reducing execution time while gaining even higher predictive accuracy. In this study, four models are examined: the classical MLP model, MLP + DP model, MLP + DP + FS model, and MLP + DP + FS + Fine tuning model.

The findings reveal that the MLP + PSO model fares better than the MLP + PCA and MLP + CC models while taking into account the number of selected features and execution time due to the MLP + PSO model's shorter processing time of 1.05:1046.33 in comparison to 1.57:1569.80 and 1.16:1157.08, respectively. The time difference that arises from this is 0.52:523.47 and 0.11:110.75, respectively. Furthermore, the MLP + PSO model maintains its position as the best predictor by using only eight features, which is a subset of the original 24 features. Furthermore, the Adam optimization algorithm performs better than the conventional SGD optimization technique. However, when accuracy is the only consideration, the results indicate that the MLP + PCA model performs better, outperforming other suggested models by 1%, with differences ranging from 5% to 16% compared to models in similar publications, as demonstrated in Table 10.

Our findings underscore the importance of feature selection from multiple sides, such as selecting the important features and reducing the time.

Based on the results of the experiments, it can be inferred that all methods effectively tackle the search problem. Configuring parameters for data uniformly can be challenging despite the MLP's strength. Adhering to MLP criteria necessitates considering factors such as sample variability, data intricacy, and suitable data preprocessing.

7. Limitations and Directions for Future Research

MLP is employed in this research in order to predict the financial performance of investment firms listed in ISX. In return, there are several limitations involved in the research. First, we only take 24 financial ratios to be the input variables of the MLP model. In the future, to address this limitation, we want to expand the number of different financial variables. Second, one machine learning technique is chosen. Thus, in the further works, it is necessary to take into account a combined approach.

In future research, we want to extend the possibilities to compare our models using more different financial variables, which will be helpful. In addition, we also expect to apply various neural network models and discuss the differences with our current work. Also, we intend to use XAI, also known as explainable artificial intelligence, which can effectively explain the reasoning behind outputs and decisions. It can be postulated that the findings of this study will have implications for enhancing decision-making and supporting the policies in management. We also suggest that investment firms make use of the results from the above indicator to improve efficiency and performance.

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Article

Clarity in Crisis: How UK Firms Communicated Risks during COVID-19

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Abstract: This study explores the influence of risk disclosure levels and types on the readability of annual reports of non-financial firms in the UK during the COVID-19 outbreak. It further investigates how the disclosure of COVID-19-related information moderates the relationship between risk disclosure and readability. The study uses a content analysis approach and CFIE software to measure the level of risk disclosure and readability in the annual reports of non-financial firms listed on the FTSE all-share from 2019 to 2021. The results show a positive and significant effect of risk disclosure level on readability, which is stronger for firms that disclosed COVID-19 information. Different types of risk disclosure have varying effects on readability, with COVID-19 risk, credit risk, and strategic risk positively affecting readability, while operational risk negatively affects it. The study contributes to the literature on information asymmetry and institutional theory by demonstrating how risk disclosure and readability are influenced by external factors like the COVID-19 outbreak and internal factors such as firm characteristics and types of risks. It introduces a new risk definition and category specific to the COVID-19 pandemic and develops new measurements for risk disclosure, including credit, liquidity, market, operational, business, strategic, and COVID-19 risks. The study provides valuable insights for managers, investors, regulators, and standard setters on the relationship between risk disclosure and readability in annual reports. It highlights the importance of disclosing COVID-19-related information to enhance the readability and understandability of financial communication. The paper contributes to the literature and practice on risk disclosure, readability, and financial communication during crises.

Keywords: risk disclosure; COVID-19 disclosure; readability; textual analysis; information asymmetry; institutional theory

1. Introduction

COVID-19 disrupted the global economy and financial markets, causing a 3% contraction in 2020, the worst since the Great Depression (IMF 2020). The pandemic also reduced profits and output, increased uncertainty and risk aversion, and stressed the financial system. The IMF projects a \$12.5 trillion loss to the world economy by 2024 due to COVID-19, as announced by its Managing Director (Reuters 2022). The crisis highlights the need for effective risk disclosure by companies, as investors demand more information about their financial health and investment risks. Companies must provide clear, accurate, and comprehensive information about their risks, mitigation plans, and COVID-19 response to demonstrate transparency and robust risk management to stakeholders and the market (Elmarzouky et al. 2021).

Risk disclosure plays a pivotal role for companies and investors. It enhances the readability of annual reports, thereby facilitating informed decisions and reducing information asymmetry. However, poor risk disclosure can lead to confusion and mistrust among users. Effective risk disclosure can reduce the cost of capital, enhance credibility, and mitigate

stock return volatility and analyst forecast dispersion (Ge and McVay 2005; Dobler 2008; Heinle and Smith 2017). It can also lessen the negative impact of asymmetrical information on reputation or financial performance (Madsen and McMullin 2020; Miihkinen 2013; Kang and Gray 2019). Furthermore, it aids in investment decision-making by reducing investor uncertainty (Elshandidy and Neri 2015). An increase in risk disclosure can positively influence a company's value, and investor expectations of future cash flows (Tan et al. 2017; Miihkinen 2013; Linsley and Shrives 2006; Kothari et al. 2009). Higher risk disclosure is associated with higher market valuation and improved operating performance (Elbannan and Elbannan 2015). It can also mitigate the impact of market momentum on the significance of a firm's risk reports (Miihkinen 2013) and help reduce the adverse effects of government safety nets (Nier and Baumann 2006). Risk disclosure is particularly beneficial for firms with limited analyst coverage, high-tech firms, and small businesses (Miihkinen 2013).

The readability of financial reports, influenced by a firm's risk-related information, impacts stakeholders' decisions. High-risk firms often disclose complex information, potentially to mask poor performance or convey negative information (Chakrabarty et al. 2018; Li 2008). Conversely, such firms may provide more comprehensible information to project transparency and decrease information asymmetry (Riley and Taylor 2014). Governance mechanisms, audit quality, and reporting standards might also affect the correlation between risk and report clarity (Prabhawa and Harymawan 2022; Bonsall and Miller 2017; Besuglov and Crasselt 2021). The complexity of the relationship between risk disclosure and readability necessitates enhanced clarity in risk disclosures (Linsley and Lawrence 2007).

This study explores the influence of risk disclosure levels and types on the readability of annual reports of non-financial firms in the UK during the COVID-19 pandemic, investigating how the disclosure of COVID-19-related information moderates the relationship between risk disclosure and readability. Employing a content analysis approach, the research provides insights into how firms communicate risks in times of crisis. Addressing the research gap on risk disclosure's impact on readability among non-financial FTSE All Share firms from 2019 to 2021, this study introduces a unique risk definition, measurement, category, and disclosure metric for the pandemic period. It employs the Information Asymmetry Theory (Akerlof 1978; Healy and Palepu 2001) and the Institutional Theory (DiMaggio and Powell 1983; Scott 1995; Meyer and Rowan 1977) to clarify the link between risk disclosure and readability, highlighting the role of disclosure in reducing information asymmetry and adhering to institutional pressures during complex risks like COVID-19.

The UK, severely impacted by COVID-19, with over 4.5 million cases and 128,000 deaths as of June 2021 (GOV.UK 2021), was chosen for this study due to several unique factors that distinguish it from other developed countries. First, the UK's regulatory environment is characterized by stringent financial reporting standards and governance frameworks, including the UK Corporate Governance Code and the UK Companies Act. These regulations mandate high levels of transparency and risk disclosure, making the UK an ideal setting to analyze how firms communicate risks during a crisis. Furthermore, the UK's recent exit from the European Union (Brexit) has created a distinct economic and regulatory environment. Companies operating in the UK are navigating new trade agreements, regulations, and economic uncertainties, which have significantly influenced their risk disclosure practices. This ongoing adjustment to a major geopolitical shift presents a valuable opportunity to investigate how firms adapt their communication strategies in response to such profound changes.

The UK's emphasis on the Stewardship Code—a voluntary code for institutional investors—encourages engagement between investors and companies on long-term issues, including risk management. The influence of this code on risk disclosure practices is a unique aspect of the UK's corporate landscape, further justifying its selection as the focus of this study. The UK's diverse economy, encompassing a wide range of non-financial firms across sectors like healthcare, technology, and retail, offers a representative sample

for examining risk disclosure practices. This diversity, coupled with the UK's status as a global financial hub, ensures that the findings of this study have broader implications, potentially informing risk disclosure practices in other international contexts. Finally, the UK's historical experience in navigating financial crises, such as the 2008 financial crash and Brexit, has cultivated a heightened awareness and responsiveness to risk management among firms. This background provides a rich context for understanding the dynamics of risk disclosure during the unprecedented challenges of the COVID-19 pandemic. By focusing on the UK, this study seeks to offer new insights into the interplay between risk disclosure and readability, particularly within the context of the unique challenges presented by the COVID-19 pandemic.

To explore these relationships, the study employs a content analysis approach using CFIE software to assess the level of risk disclosure and readability in the annual reports of non-financial firms listed on the FTSE All-Share from 2019 to 2021. This period captures the critical phases before, during, and after the COVID-19 pandemic, allowing for a comprehensive analysis of how firms adapted their communication strategies in response to the crisis. The methodology involves developing a detailed risk disclosure index and applying regression models to test the impact of various risk disclosure types on readability, with a particular focus on the moderating role of COVID-19-related disclosures.

This study reveals a positive interaction between a firm's risk-related information and readability, with firm size and profitability positively impacting readability, while board size negatively impacts readability. The interaction between risk disclosure level and COVID-19 disclosure is significantly positive, indicating a stronger effect on readability for firms that disclosed COVID-19 information. The study examines the effects of different types of risk disclosure on readability, with COVID-19 risk, credit risk, and strategic risk positively affecting readability, while operational risk negatively affects it.

The paper elucidates the implications of these findings for both theory and practice. Theoretically, the study advances the literature by elucidating the interplay between risk disclosure, readability, and the COVID-19 pandemic. Theoretically, it extends the understanding of information asymmetry and institutional theory by demonstrating how both external factors, such as the COVID-19 outbreak, and internal factors, including firm characteristics and types of risks, influence risk disclosure and readability. By introducing a new risk definition and category specific to the COVID-19 pandemic, the study enhances existing theoretical frameworks and provides a basis for future research. Furthermore, it develops novel measurements for risk disclosure, encompassing credit, liquidity, market, operational, business, strategic, and COVID-19 risks, thereby advancing methodological approaches in the field. Methodologically, the introduction of a specific COVID-19 risk category contributes to future research by offering a framework that can be utilized in subsequent studies. The findings also provide practical insights for managers, investors, regulators, and standard setters on improving risk disclosure and readability during crises. By emphasizing the importance of clear and comprehensive risk disclosures, the study highlights how firms can enhance stakeholder trust and facilitate informed decision-making. Practically, the paper offers insights on improving risk disclosure and readability during crises. It finds that risk disclosure enhances readability, with COVID-19 risk, credit risk, operational risk, and strategic risk having the most impact. The paper emphasizes the importance of disclosing COVID-19-related information and suggests that firms should disclose the most relevant risks. It also highlights the role of regulators and standard setters in enforcing plain English and risk disclosure regulations. The paper contributes to the literature and practice on risk disclosure, readability, and financial communication during crises, providing valuable insights for firms, investors, and regulators.

This paper is organized into five sections. Section 2 provides the Literature Review, Theoretical Framework, and hypothesis development for the study. Section 3 details the research methodology used. Section 4 presents the empirical results of the study. Section 5 details discussion, and finally, the fifth section provides conclusions and suggestions for future research.

2. Literature Review, Theoretical Framework, and Hypothesis Development

2.1. Risk Disclosure in the COVID-19 Outbreak

Risk is a complex concept that has various definitions and classifications depending on the perspective and context (Schrand and Elliott 1998; Cabedo and Tirado 2004; Horcher 2005; Institute of Chartered Accountants in England and Wales 2016). For the purpose of this study, risk is defined as “a measurable outcome or probability of future events resulting from the interaction of internal and external factors affecting a firm’s wealth and value.” Risk disclosure is “the communication of information concerning risks or anything that may lead to risks to the users of financial statements”. Risk disclosure can be categorized into three types: COVID-19-related risk disclosure, financial, and non-financial risk disclosure. COVID-19 risk disclosure provides information on potential harm from the SARS-CoV2 virus and pandemic, including public health, economic, and societal risks (Deloitte 2020; Elmarzouky et al. 2021). Financial risk disclosure communicates potential financial losses impacting financial assets and obligations, such as credit, liquidity, market, and operational risk (Cabedo and Tirado 2004). Non-financial risk disclosure communicates risks leading to cash flow losses, like strategic and business risks not linked to financial performance (Cabedo and Tirado 2004). A comprehensive understanding of these risks and disclosures is crucial for evaluating a company’s risk profile and making informed decisions, contingent on clear and concise communication.

2.2. The Usefulness of Risk Disclosure

Over the years, numerous studies have highlighted the benefits of risk disclosure, including capital cost reduction, information asymmetry mitigation, investment decision-making enhancement, risk disclosure quality improvement, and market impact reduction. These benefits positively influence a company’s financial performance, including operating performance, market valuation, and overall value.

One significant advantage of risk disclosure is the reduction in capital costs. By providing investors with valuable risk information, improving their understanding of a company’s financial situation, reducing capital costs (Ge and McVay 2005; Dobler 2008; Heinle and Smith 2017), increasing credibility, and decreasing stock return volatility and analyst forecast dispersion (Ge and McVay 2005). Also, risk disclosure plays a crucial role in mitigating information asymmetry. Publicly available risk information can help reduce agency costs (Miihkinen 2013) and mitigate the negative impacts of asymmetrical information on reputation or financial performance (Madsen and McMullin 2020; Miihkinen 2013; Kang and Gray 2019). Furthermore, effective risk disclosure enhances investment decision-making. By reducing investor uncertainty (Elshandidy and Neri 2015), providing hazard transparency (Campbell et al. 2014), and facilitating informed investment decision-making. Increased risk disclosure can positively impact a company’s overall value and influence investor expectations of future cash flows (Tan et al. 2017; Miihkinen 2013; Linsley and Shrives 2006; Kothari et al. 2009). Moreover, the quality of risk disclosure can be enhanced through increased specificity (Hope et al. 2016) and improved perceived value of auditor services (Fukukawa and Kim 2017). Higher risk disclosure is associated with higher market valuation and improved operating performance (Elbannan and Elbannan 2015). Lastly, risk disclosure helps mitigate market impacts. It reduces the influence of market momentum on the significance of a firm’s risk reports (Miihkinen 2013) and helps reduce the adverse effects of government safety nets (Nier and Baumann 2006). This is particularly beneficial for firms with limited analyst coverage, high-tech firms, and small businesses (Miihkinen 2013).

2.3. Risk Disclosure, Readability, and COVID-19

The readability of financial reports affects the decision-making of various stakeholders, such as investors, auditors, and regulators. However, previous studies have reported inconsistent results on the impact of the firm’s risk-related information on readability. The intricate relationship between risk disclosure and the readability of financial reports remains

an unresolved issue. Research by Chakrabarty et al. (2018) and Li (2008) indicates that firms with higher risk profiles often disclose information that is complex and challenging to understand. Such complexity can serve to mask poor performance, avert litigation, facilitate actions that destroy value, or convey negative information.

On the other hand, some research, such as that by Riley and Taylor (2014), suggests that high-risk firms may provide more comprehensible information to project transparency and credibility or to decrease information asymmetry and agency costs. They posited that nonprofessional investors could benefit from risk disclosures written in plain English. However, other studies like those by Prabhawa and Harymawan (2022), Bonsall and Miller (2017), and Besuglov and Crasselt (2021) propose that factors such as governance mechanisms, audit quality, and reporting standards might also affect the correlation between risk and report clarity. Linsley and Lawrence (2007) found the risk disclosures in annual reports to be challenging to understand, implying a need for directors to enhance clarity. This highlights the complexity of the relationship between risk disclosure and readability, warranting further investigation.

Recent studies have shown that the independence of a board plays a significant role in enhancing the readability of annual reports. Independent boards are more likely to ensure that financial reports are clear and transparent, thereby improving readability and overall information quality (Rahman and Kabir 2023). The readability of financial reports has a direct impact on corporate behavior, particularly in the banking sector. Riley and Taylor (2014) provide a notable study on the relationship between risk disclosure and readability. They find that firms with more comprehensive risk disclosures tend to have more readable annual reports, positing that plain English in communicating risks can improve stakeholder comprehension and decision-making. This indicates that transparency and clarity in risk reporting have the potential to enable more informed judgments. However, as the authors note, the influence of risk information on readability remains an intriguing area for further research. This emphasizes the multifaceted association between risk disclosure and annual report readability, highlighting a need for ongoing investigation. Improved readability of risk disclosures in financial documents, such as bond prospectuses, has been shown to reduce credit risk premiums. Clearer disclosures enable investors to better assess risks, leading to lower perceived risk and, consequently, a lower credit risk premium (Yao et al. 2024).

Based on this Theory and the previous studies, we hypothesize that:

H1: *Firms with higher levels of risk disclosure have more readable annual reports.*

The Institutional Theory (DiMaggio and Powell 1983; Scott 1995; Meyer and Rowan 1977) suggests firms conform to institutional pressures for legitimacy, amplified by COVID-19 risks. These pressures, including norms, values, and expectations, influence firm behavior. Firms seek legitimacy, enhancing survival and performance, especially during crises. The COVID-19 pandemic has introduced new institutional pressures due to increased global uncertainty, volatility, and complexity. It has also heightened stakeholder demand for transparency and disclosure. Firms are expected to disclose their response to the pandemic and how they manage its risks and impacts. This voluntary COVID-19 disclosure signals firm preparedness, demonstrating social responsibility and accountability. It can enhance firm legitimacy, reputation, and stakeholder communication.

Previous studies have examined the relationship between risk disclosure and readability. Riley and Taylor (2014) found that firms that disclose risks more extensively have annual reports that are easier to read, implying that using simple language to convey risks can enhance stakeholder understanding and decision-making. This suggests that risk reporting that is transparent and clear can facilitate more informed judgments. However, they also acknowledge that the impact of risk information on readability is a fascinating topic for further research (Riley and Taylor 2014). This emphasizes the complex relationship between risk disclosure and annual report readability, indicating a need for continued investigation.

Elmarzouky et al. (2021) extend this line of inquiry by examining the effect of COVID-19 disclosure on uncertainty in annual reports. They find that there is a positive relationship between COVID-19 disclosure and uncertainty, suggesting that firms use COVID-19 disclosure to cope with the increased ambiguity and unpredictability caused by the pandemic. Based on the Institutional Theory and the previous studies, we hypothesize that:

H2: *The positive relationship between risk disclosure and readability is stronger for firms that disclosed COVID-19-related information.*

As we delve deeper into this topic, it becomes evident that the influence of a firm's risk-related information on the comprehensibility of financial reports remains an open research question, particularly in the context of global crises such as COVID-19. This study integrates the Information Asymmetry and Institutional Theories to explore the relationship between risk disclosure and readability during the COVID-19 outbreak. Asymmetry Theory, as developed by Akerlof (1978), and Healy and Palepu (2001), emphasizes the role of voluntary disclosure in bridging the information gap between firm managers and external users, thereby enhancing transparency. This theory suggests that risk disclosure can mitigate the adverse effects of information asymmetry—such as adverse selection and moral hazard—by providing valuable insights into potential outcomes and the probabilities of future events affecting a firm's wealth and value. Improved transparency through risk disclosure can reduce uncertainty and increase trust in the firm, thereby facilitating more informed decision-making by external users. However, readability, which is essential for comprehension, plays a crucial role in determining how effectively this disclosed information is received and interpreted by stakeholders. Depending on text clarity and complexity, readability can either enhance or impair the effectiveness of risk disclosures. Having developed our hypotheses based on the theoretical framework, we now turn to the research gap and the purpose of our study: to examine the effect of risk reporting on readability in the context of the COVID-19 pandemic. Despite the extensive literature on risk disclosure and its acknowledged benefits, a significant gap persists in understanding how different types of risk disclosures influence the readability of financial reports during a global crisis like COVID-19. While prior research has extensively explored the relationship between risk disclosure and various corporate outcomes—such as financial performance, market reactions, and investor behavior—it has largely overlooked the specific impact of risk disclosure on the readability of annual reports during major crises. This study seeks to address this deficiency by providing empirical evidence on the interplay between risk disclosure, readability, and the moderating role of COVID-19 disclosure. The pandemic has introduced new and complex risks, profoundly affecting the global economy and business operations. Consequently, there is a pressing need for empirical evidence on how firms communicate and evaluate risk information in this unprecedented environment. By focusing on this underexplored area, our research aims to offer novel insights into the relationship between risk disclosure and readability, thereby contributing to a deeper understanding of financial reporting in times of crisis.

3. Methodology

3.1. Sample Selection and Data Collection

The study utilized a sample consisting of 353 non-financial companies listed on the UK FTSE-All Share during the fiscal years of 2019 to 2021. The period from 2019 to 2021 was selected for this study due to its critical relevance to the COVID-19 pandemic and its profound impact on global economies and financial reporting practices. This timeframe encompasses pre-pandemic conditions, the peak of the crisis, and the early recovery stages, allowing for a comprehensive analysis of how firms adapted their risk disclosure practices in response to the unprecedented challenges posed by COVID-19. The year 2019 serves as a baseline, capturing the state of risk disclosure prior to the pandemic, while the subsequent years, 2020 and 2021, represent the height of the crisis, during

which firms faced significant pressure to enhance their risk communication strategies. This selection facilitates an in-depth examination of how the pandemic influenced risk disclosure practices and the readability of annual reports among non-financial firms listed on the FTSE All-Share. The study employs data from this period to capture the initial and most impactful phase of the pandemic, providing valuable insights into the interplay between risk disclosure, readability, and the evolving regulatory landscape. The UK's robust regulatory framework, Brexit-induced economic shifts, investor-focused governance, and historical crisis experience render it an optimal context for analyzing the interplay between risk disclosure and readability during the COVID-19 pandemic. These factors provide a representative sample for exploring differences and similarities among firms. The research utilized annual reports from the chosen firms, which were procured from their online websites and analyzed using automated content analysis techniques and a software program known as CFIE, which was developed by Lancaster University. This methodology entailed extracting relevant narrative information related to risk disclosure and scoring and analyzing these disclosures using the CFIE software. The information for companies listed on the FTSE All-share was collected from the Bloomberg database, while the financial data were obtained from the Eikon database.

3.2. Variable Coding and Measurement

3.2.1. Development of the Risk Disclosure Index

The risk disclosure index was meticulously developed through a systematic and multi-faceted approach, incorporating insights derived from both the academic literature and empirical data. The study employed a self-constructed disclosure index (Table 1) and adopted a content analysis methodology to assess risk disclosure levels across a range of categories: COVID-19, credit risk, operational risk, liquidity risk, market risk, strategic risk, and business risk. The creation of the risk disclosure wordlist entailed an exhaustive review of pertinent literature combined with an empirical analysis of corporate reports, encompassing both financial and non-financial risks as well as specific terminologies related to COVID-19. This rigorous methodology ensured the index's robustness and accuracy in evaluating risk disclosures.

Table 1. Risk disclosure index.

Panel A		Panel B	
COVID-19 Related information		Financial Risk Disclosure:	
Corona	Quarantine	Operational Risks	Market Risks
Contagion	Super-spreader	Fraud	Foreign Exchange
Outbreak	Death	Fault	Interest
COVID#	Disaster	Mistake	Fair value
Social distancing	Havoc	Defect	Commodity price
SARS-CoV-2	Destruction	Dilemma	Volatility
Spread	Crisis	Challenge	Collapse
Epidemic	Toxin	Weakness	Shortage
Pandemic#	Infection	Impairment	Fluctuation
Hand wash	Victim	Dissatisfaction	Variation
Facemask	Damage	Unsatisfactory	Pricing
Redundancy	Severity	Unable	Credit Risks
Safety measures	Serious	Loss	Gearing
Working online	Accident	Shrinkage	Insolvency

Table 1. *Cont.*

Working from home	Harm	Troubles	Bankruptcy
Herd immunity	Suffer	Contingency	Failure
Lockdown	Self-isolation	Failure	Variation
Vaccine		Scarcity	Change
		Liquidity Risks	Insufficiency
		Shortage	Deficit
		Not trading	Evade
		Frequency	
		Distress	
Panel C			
Non-Financial Risk disclosure:			
Business risk disclosure		Strategic risk disclosure	
Corruption	Insecure	Competence	Uncertain
Misuse	Conflict	Revolution	Struggle
Collapse	Violate	Coup	Emergency
Exposure	Steal	Violence	Deficiency
Danger	Theft	Instability	Shock
Threat	FALSE	Protests	Strikes
Hazard	fire	Terrorism	Float
Harm	Damage	War	Incidents
Loss	Victim	Collapse	Laws
Fault	Fraud	Conflict	Political
Mistake	Cheat	Damage	Environment
Hack	Deceive	Lawsuit	Disaster
Attack	Fake		
Crack	Corruption		
Spyware	Crime		
Virus	Lawsuits		
Cheat	Litigation		

The development of the risk disclosure index began with a comprehensive literature review, which established the theoretical foundation and identified key categories of risk disclosure. Following this, an exploratory analysis of a random sample of UK corporate annual reports was conducted to assess the scope and variety of risk disclosures. This investigation refined the risk disclosure categories by identifying common themes and practices among UK firms. A broad set of keywords related to risk disclosure was identified, including synonyms, to ensure comprehensive coverage. These keywords were filtered based on their frequency and relevance in the annual reports, resulting in a focused and representative wordlist. The wordlist was further refined to include COVID-19 disclosures, guided by the World Health Organization (WHO) and other relevant sources, encompassing both financial and non-financial risks. Moreover, two- and three-word phrases were developed to improve the robustness of the disclosure quality, as recommended in existing literature. The NVivo 12 Pro software was employed to systematically analyze the annual reports of non-financial firms listed on the FTSE All-Share index, identifying the most frequently used terms associated with risk disclosure. Subsequently, LancsBox

software 5.0.1 was utilized to trace these keywords within the text, ensuring that at least 75% of relevant disclosures were captured. Independent analyses were conducted by the researchers, followed by a consensus process to finalize the keyword list, ensuring both accuracy and comprehensiveness. Finally, CFIE software was used to score the reports by processing the wordlists and organizing the results for further analysis. This systematic approach enabled a detailed assessment of risk disclosure across various categories. The index is presented in Table 1 below.

3.2.2. Measuring Readability

Readability is the ease of reading and understanding a text, which depends on various factors, such as word and sentence length and complexity, punctuation and formatting, and content clarity and coherence (Loughran and McDonald 2014). Readability influences the communication and transparency between the writer and the reader, and the information transfer effectiveness and efficiency. Therefore, readability is a key aspect of the annual reports quality and usefulness, as it affects the stakeholders' decision-making and behavior. This research employed CFIE software to conduct an automatic assessment of readability. The Flesch Reading Ease score, which spans from 0 to 100, indicates that higher scores correlate with greater readability.

3.2.3. Control Variables

Our regression models include various control variables to examine the relationship between risk disclosure and readability and the effect of COVID-19 disclosure on this relationship. The control variables are defined in Table 2.

Table 2. Control variables measurements:.

Variable	Symbol	Definitions and Measurements
Firm Size	FSIZE	Logarithm of the company's total assets (Moussa and Elmarzouky 2024a)
Liquidity	LIQ	Evaluated through the current ratio, which demonstrates the company's capacity to fulfill immediate financial obligations using its current assets (Moussa and Elmarzouky 2024b)
Profitability	ROA, ROE	Expressed by both return on assets (ROA) and return on equity (ROE), these metrics mirror the financial performance of the company (Moussa and Elmarzouky 2023; Giannopoulos et al. 2022)
Leverage	LEV	Measured by the debt-to-equity ratio, indicating the company's reliance on debt financing (Moussa 2024)
Board Size	BSIZE	Quantity of board members (Endrikat et al. 2021)
Independent Board	INDB	Percentage of board members with no ties to company management or significant shareholders (Endrikat et al. 2021)
Audit Committee Non-Executives	ACNEX	Inclusion of non-executive members in the firm's audit committee, free from company management influence
Audit Committee Independence	ACIND	Proportion of independent directors on the company's audit committee

3.3. Empirical Models and Econometric Techniques

We use regression to test the effect of Risk Disclosure Level (RDL) on readability and the moderating role of COVID-19 disclosure. The models used in this study are as follows:

The First model:

$$\text{Flesch} = \beta_0 + \beta_1\text{RDL} + \beta_2\text{FSIZE} + \beta_3\text{LIQ} + \beta_4\text{ROA} + \beta_5\text{LEV} + \beta_6\text{BSIZE} + \beta_7\text{INDB} + \beta_8\text{ACNEX} + \beta_9\text{ACIND} + \varepsilon$$

The second model:

$$\text{Flesch} = \beta_0 + \beta_1\text{RDL} + \beta_2(\text{C.RDL}\#\text{C.COVID}) + \beta_3\text{FSIZE} + \beta_4\text{LIQ} + \beta_5\text{ROA} + \beta_6\text{LEV} + \beta_7\text{BSIZE} + \beta_8\text{INDB} + \beta_9\text{ACNEX} + \beta_{10}\text{ACIND} + \varepsilon$$

In the first model, Flesch reading ease score is the outcome variable, with Risk Disclosure Level (RDL) as the main predictor. Control variables include firm size (FSIZE), liquidity (LIQ), profitability (ROA), leverage (LEV), board size (BSIZE), independent board (INDB), audit committee non-executives (ACNEX), and audit committee independence (ACIND).

The second model adds an interaction term (C.RDL#C.COVID) to capture the moderating effect of COVID-19 disclosure on the relationship between RDL and Flesch. The control variables remain the same as in the first model. Both models have limitations in capturing specific variations in Flesch, represented by the error term (ε).

4. Empirical Results

4.1. Descriptive Statistics

Table 3 presents the descriptive statistics summarizing the variables used in the study. Panel A summarizes the descriptive statistics for the variables utilized in this study, providing insights into their central tendencies and dispersions. The readability scores exhibit a minimum of 0 and a maximum of 58.979, with a mean of 18.629, indicating a wide range of readability across the reports analyzed. The risk disclosure level (RDL) shows significant variation, with a minimum of 0, a maximum of 2919, and an average score of 310.703. Regarding control variables, firm size ranges from 11.426 to 17.501 with a mean of 13.909. Liquidity ranges from 0.14 to 20.91 with a mean of 1.644. Profitability varies from -0.853 to 0.345, with a mean of 0.04. Leverage ranges from 0 to 0.849, averaging at 0.178, while board size ranges from 3 to 12 with a mean of 7.528. Independent board representation ranges from 17.65 to 100 with a mean of 67.546, and audit committee non-executives range from 20 to 100 with a mean of 98.021. Audit committee independence spans from 33.33 to 100 with a mean of 93.475.

Table 3. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A					
Flesch	730	18.629	24.619	0	58.979
RDL	1966	310.703	472.067	0	2919
FSIZE	1795	13.909	1.591	11.426	17.501
LIQ	822	1.644	1.37	0.14	20.91
ROA	1481	0.04	0.102	-0.853	0.345
LEV	1474	0.178	0.171	0	0.849
BSIZE	1969	7.528	2.43	3	12
INDB	1041	67.546	18.44	17.65	100
ACNEX	1011	98.021	6.873	20	100
ACIND	1024	93.475	12.923	33.33	100
Panel B					
Variable	Obs	Mean	Std. Dev.	Min	Max
COVID	737	153.488	147.23	0	859
CRRD	737	97.126	53.534	0	400
OPRD	737	197.958	99.78	4	666
LIQRD	737	4.38	5.264	0	36
MRRD	737	230.783	116.338	0	874
STGRD	737	89.687	47.967	3	328
BUSRD	737	55.402	52.212	0	395

In addition to these variables, Panel B summarizes the descriptive statistics for various risk disclosure categories, providing further insights into their levels during the study period. The COVID-19 risk disclosure scores range from a minimum of 0 to a maximum of 859, with a mean score of 147.23, indicating varying levels of disclosure among firms regarding pandemic-related risks. Credit risk disclosure ranges from 0 to 400, with a mean of 97.126, while operational risk scores range from 4 to 666, averaging at 197.958. Liquidity

risk scores vary from 0 to 36, yielding a mean of just 4.38, and market risk scores range from 0 to 874, with a mean score of 230.783. Strategic risk disclosure shows a range from 3 to 328, averaging at 89.687, whereas business risk scores range from 0 to 395 with a mean of 55.402.

4.2. Pairwise Correlations

The pairwise correlations, displayed in Table 4, show the strength and direction of the linear relationship between each pair of variables used in the study. These correlations indicate the degree of association and the potential multicollinearity among the variables. The pairwise correlations reveal that the readability (Flesch) has a moderate positive correlation with the risk disclosure level (RDL) and the firm size (FSIZE), meaning that these variables tend to increase or decrease together. The readability has a weak positive correlation with the board size (BSIZE) and the independent board (INDB), meaning that these variables have a slight positive relationship. The readability has a weak negative correlation with the liquidity (LIQ), the profitability (ROA), the leverage (LEV), the audit committee non-executives (ACNEX), and the audit committee independence (ACIND), meaning that these variables tend to move in opposite directions. The pairwise correlations provide a preliminary analysis of the data set and its relationships.

Table 4. Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	VIF
(1) Flesch	1.000										2.249
(2) RDL	0.340 *	1.000									1.722
(3) FSIZE	0.268 *	0.362 *	1.000								1.626
(4) LIQ	−0.009	−0.058 *	−0.115 *	1.000							1.581
(5) ROA	−0.005	0.040	−0.132 *	0.195 *	1.000						1.564
(6) LEV	−0.028	0.276 *	0.288 *	−0.231 *	−0.145 *	1.000					1.19
(7) BSIZE	0.310 *	0.246 *	0.572 *	−0.550	−0.450 *	0.386 *	1.000				1.162
(8) INDB	0.061	−0.290 *	0.082 *	−0.021	−0.015	−0.193 *	−0.261 *	1.000			1.137
(9) ACNEX	−0.047	−0.044	0.087 *	0.064	0.010	−0.026	−0.037	0.156 *	1.000		1.117
(10) ACIND	−0.022	−0.092 *	0.139 *	0.031	0.013	−0.022	0.037	0.460 *	0.296 *	1.000	1.483

Standard errors in parentheses. * $p < 0.1$; the table presents the correlation matrix.

The weak relationship between the independent and control variables suggests that there is no significant multicollinearity in the data. This conclusion was supported by the calculation of variance inflation factors (VIF), and as none of the VIF values exceeded the threshold, it confirms that there is no presence of multicollinearity.

4.3. Multivariate Analysis

Table 5 shows the results of the OLS, random, and Tobit regression analyses of the impact of RDL on the readability of the annual reports of non-financial firms listed on the FTSE All Shares index. The justification for our choice of regression models is rooted in the panel data nature of our data set. We utilize ordinary least squares (OLS) regression to explore the relationships between variables. We have conducted preliminary tests to ensure our data meet the assumptions required for Ordinary Least Squares (OLS) regression, including normality and linearity. We also performed the Hausman specification test to identify the most suitable model. The results yielded a chi-square value of 1.002 and a p -value of 0.998, indicating no significant difference between the fixed and random effects models. Consequently, we determined that the random effects model is the most appropriate for our analysis, as it offers more efficient estimates and accommodates time-invariant variables. We employed Tobit regression because our dependent variable is non-negative and restricted to positive values, allowing us to account for the censoring of values at zero. The results indicate that RDL and readability have a positive and significant relationship at a 5% significance level in all models, suggesting that firms that provide more detailed information about their risks have higher readability scores, meaning that their annual reports are easier to read and understand. The results are consistent across all models, indicating the robustness of the findings. The results also show that some of

the control variables have a significant impact on readability. Firm size and profitability have a positive and significant relationship with it, meaning that larger and more profitable firms have higher readability scores. Board size has a negative and significant relationship with it, meaning that firms with larger boards have lower readability scores. The other control variables have no significant relationship with readability, meaning that they do not affect this measure. The results support the hypothesis that firms with higher levels of risk disclosure have more readable annual reports, and provide evidence for the applicability and relevance of the Information Asymmetry Theory (Akerlof 1978; Healy and Palepu 2001). This theory suggests that firms disclose more information to reduce the information gap between managers and investors and to signal their quality and performance. Table 5 confirms this hypothesis, as it indicates that firms that disclose more information about their risks have higher readability scores, which means that their annual reports are easier to read and understand. This finding implies that firms use risk disclosure as a signaling mechanism to communicate their risks more clearly and transparently to their stakeholders, enhancing their credibility and facilitating informed decision-making. Our result is also in line with the existing literature on risk disclosure and information asymmetry. For instance, Riley and Taylor (2014) found that firms that disclose risks more extensively have annual reports that are easier to read, implying that using simple language to convey risks can enhance stakeholder understanding and decision-making. This suggests that risk reporting that is transparent and clear can facilitate more informed judgments. However, they also acknowledge that the impact of risk information on readability is a fascinating topic for further research.

Table 5. The effect of RDL on Readability.

	OLS	Random	Tobit
Variables	Flesch	Flesch	Flesch
RDL	0.717 ** (0.389)	0.717 ** (0.389)	0.717 ** (0.385)
FSIZE	0.416 ** (1.227)	0.416 ** (1.227)	0.416 ** (1.213)
LIQ	−0.182 (1.146)	−0.182 (1.146)	−0.182 (1.133)
ROA	13.50 ** (16.14)	13.50 ** (16.14)	13.50 ** (15.97)
LEV	−7.600 (8.676)	−7.600 (8.676)	−7.600 (8.580)
BSIZE	−0.783 ** (0.823)	−0.783 ** (0.823)	−0.783 ** (0.813)
INDB	0.138 (0.122)	0.138 (0.122)	0.138 (0.121)
ACNEX	−0.115 (0.164)	−0.115 (0.164)	−0.115 (0.162)
ACIND	−0.128 (0.111)	−0.128 (0.111)	−0.128 (0.110)
Constant	30.71 (19.24)	30.71 (19.24)	30.71 (19.02)
Observations	453	453	453
R-squared	0.022		
Number of Year		3	

Standard errors in parentheses. ** $p < 0.05$.

4.4. Moderating Effect of COVID-19 Disclosure

The regression analysis results, presented in Table 6, demonstrate the moderating effect of COVID-19 disclosure on the relationship between risk disclosure level and readability of annual reports from non-financial firms listed on the FTSE All Shares index. These results suggest that firms providing detailed information about their risks and COVID-19 impacts

achieve higher readability scores, indicating their annual reports are more comprehensible. The analysis also reveals that control variables like firm size, profitability, and board size significantly affect readability. However, variables such as liquidity, leverage, industry dummy, audit committee expertise, and audit committee independence do not significantly impact readability.

Table 6. Moderating effect of COVID-19 disclosure on the relationship between RDL and readability.

	OLS	Random	Tobit
Variables	Flesch	Flesch	Flesch
C.RDL#C.COVID	5.89 *** (5.59)	5.89 *** (5.59)	5.89 *** (5.52)
FSIZE	0.998 ** (1.182)	0.998 ** (1.182)	0.998 ** (1.169)
LIQ	−0.0388 (1.361)	−0.0388 (1.361)	−0.0388 (1.346)
ROA	17.97 ** (16.73)	17.97 ** (16.73)	17.97 ** (16.54)
LEV	−7.900 (9.137)	−7.900 (9.137)	−7.900 (9.034)
BSIZE	−0.618 ** (0.831)	−0.618 ** (0.831)	−0.618 ** (0.822)
INDB	0.151 (0.124)	0.151 (0.124)	0.151 (0.123)
ACNEX	−0.113 (0.166)	−0.113 (0.166)	−0.113 (0.164)
ACIND	−0.134 (0.113)	−0.134 (0.113)	−0.134 (0.112)
Constant	25.90 (19.31)	25.90 (19.31)	25.90 (19.09)
Observations	444	444	444
R-squared	0.018		
Number of Year		3	

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

Our study confirms the hypothesis that the positive relationship between risk disclosure and readability is stronger for firms that disclosed COVID-19-related information. This implies that firms disclosing more COVID-19 information were more responsive to the increased demand for transparent reporting during the pandemic, signaling their awareness and preparedness to stakeholders. However, such reporting may introduce complexity and uncertainty, emphasizing the importance of readability and clarity. The significant moderating effect of COVID-19 disclosure supports the applicability of the Institutional Theory (DiMaggio and Powell 1983; Scott 1995; Meyer and Rowan 1977), suggesting firms conform to their institutional environment's norms and expectations, adopting similar practices to gain legitimacy and support.

These results align with the existing literature, such as Riley and Taylor (2014), who found that firms disclosing risks more extensively produce easier-to-read annual reports. This suggests transparent and clear risk reporting can facilitate more informed judgments. Elmarzouky et al. (2021) extend this inquiry by examining the effect of COVID-19 reporting on uncertainty in annual reports, finding a positive relationship, indicating firms use COVID-19 reporting to cope with the pandemic's increased ambiguity and unpredictability. However, the impact of risk information on readability warrants further research.

4.5. Robustness Check

The robustness check of this study's findings replaced the profitability variable (ROA) with another common measure, return on equity (ROE), and recalculated the multivariate regression models following (Moussa and Elmarzouky 2023). Table 7 presents the

results of this check, confirming a consistent and significant effect of the interaction term “C.RDL#C.COVID” on readability score at 5% across all four regression models (OLS, random effects, and Tobit). This indicates that firms providing detailed risk and COVID-19 information tend to have higher readability scores, suggesting their annual reports are more comprehensible.

Table 7. Robustness check.

	OLS	Random	Tobit
Variables	Flesch	Flesch	Flesch
C.RDL#C.COVID	7.15 ** (5.75)	7.15 ** (5.75)	7.15 ** (5.68)
FSIZE	1.313 ** (1.190)	1.313 ** (1.190)	1.313 ** (1.176)
LIQ	−0.286 (1.358)	−0.286 (1.358)	−0.286 (1.342)
ROE	17.15 ** (19.07)	17.15 ** (19.07)	17.15 ** (18.84)
LEV	−10.10 (9.737)	−10.10 (9.737)	−10.10 (9.623)
BSIZE	−0.762 ** (0.853)	−0.762 ** (0.853)	−0.762 ** (0.843)
INDB	0.148 (0.128)	0.148 (0.128)	0.148 (0.127)
ACNEX	−0.0765 (0.176)	−0.0765 (0.176)	−0.0765 (0.174)
ACIND	−0.141 (0.116)	−0.141 (0.116)	−0.141 (0.115)
Constant	19.31 (19.95)	19.31 (19.95)	19.31 (19.72)
Observations	430	430	430
R-squared	0.019		
Number of Year		3	

Standard errors in parentheses. ** $p < 0.05$.

The results also reveal that control variables like firm size, profitability, and board size significantly affect readability. Larger, more profitable firms with bigger boards tend to have higher readability scores. However, firms with larger boards tend to have lower readability scores. Variables such as liquidity, leverage, independent board, audit committee non-executives, and audit committee independence do not significantly impact readability. These results are consistent across all models, indicating the analysis’s validity.

4.6. Additional Analyses

4.6.1. The Effect of Different Types of Risk Disclosure on the Readability

Table 8 presents the results of additional analyses examining the impact of different types of risk disclosure on the readability of annual reports from non-financial firms listed on the FTSE All Shares index. The analyses reveal a positive and significant relationship between COVID-19 disclosure and readability at a 5% significance level across all regression models. This indicates that firms providing detailed COVID-19 information tend to have higher readability scores, suggesting their annual reports are more comprehensible.

The analyses also show that different types of risks significantly impact readability. Credit risk disclosure (CRRD) and strategic risk disclosure (STGRD) positively correlate with readability, implying that firms disclosing more information about these risks produce more informative and clearer annual reports. Conversely, operational risk disclosure (OPRD) negatively correlates with readability, suggesting that firms disclosing more information about this risk produce more complex and obscure annual reports. Liquidity risk

disclosure (LIQRD), market risk disclosure (MRRD), and business risk disclosure (BUSRD) do not significantly impact readability.

Table 8. The effect of risk disclosure types on readability.

	OLS	Random	Tobit
Variables	Flesch	Flesch	Flesch
COVID	0.680 ** (0.00988)	0.680 ** (0.00988)	0.680 ** (0.00970)
CRRD	0.0876 * (0.0463)	0.0876 * (0.0463)	0.0876 * (0.0455)
OPRD	−0.288 ** (0.0223)	−0.288 ** (0.0223)	−0.288 ** (0.0219)
LIQRD	−0.119 (0.285)	−0.119 (0.285)	−0.119 (0.280)
MRRD	0.00391 (0.0203)	0.00391 (0.0203)	0.00391 (0.0199)
STGRD	0.0872 *** (0.0488)	0.0872 *** (0.0488)	0.0872 *** (0.0479)
BUSRD	−0.0451 (0.0414)	−0.0451 (0.0414)	−0.0451 (0.0406)
FSIZE	0.676 ** (1.389)	0.676 ** (1.389)	0.676 ** (1.364)
LIQ	−0.0535 (1.445)	−0.0535 (1.445)	−0.0535 (1.418)
ROA	28.14 ** (17.83)	28.14 ** (17.83)	28.14 ** (17.51)
LEV	−6.570 (9.264)	−6.570 (9.264)	−6.570 (9.096)
BSIZE	−0.668 ** (0.846)	−0.668 ** (0.846)	−0.668 ** (0.831)
INDB	0.110 (0.125)	0.110 (0.125)	0.110 (0.123)
ACNEX	−0.123 (0.166)	−0.123 (0.166)	−0.123 (0.163)
ACIND	−0.134 (0.114)	−0.134 (0.114)	−0.134 (0.112)
Constant	44.63 ** (20.67)	44.63 ** (20.67)	44.63 ** (20.30)
Observations	444	444	444
R-squared	0.042		
Number of Year		3	

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The additional analyses, conducted to test the robustness and validity of our results, utilized different regression models to control for potential outliers, heteroscedasticity, endogeneity, and censoring issues. The results, shown in Table 8, confirm the main findings. The varying effects of different risk types on readability align with the Proprietary Cost Theory, which posits that firms balance the benefits and costs of disclosure, especially when the information is proprietary or sensitive.

For instance, COVID-19 risk disclosure may positively impact readability as firms disclose more information about their COVID-19 response and impact to signal transparency and legitimacy to stakeholders and reduce the uncertainty and complexity of the pandemic. However, it may negatively impact readability if firms disclose more complex and uncertain information about COVID-19 risks and uncertainties, impairing user comprehension and interpretation.

Similarly, credit risk disclosure may positively impact readability as firms disclose more information about their credit risk exposure and management to reduce information

asymmetry and enhance credibility with creditors and investors. However, it may negatively impact readability if firms disclose more technical and detailed information about their credit risk measurement and reporting, increasing the complexity and difficulty of the text.

The results of the additional analyses align with the theories used for the main analyses, such as the information asymmetry theory, the institutional theory, and also the proprietary cost theory. These theories provide explanations and interpretations for the relationship between risk disclosure and readability and the impact of COVID-19 disclosure and different types of risks on this relationship. The additional analyses confirmed and supported our main results, finding similar coefficients and significance levels for the main variables of interest, such as RDL, COVID, and the different types of risks. The results also showed that our main results were robust and valid across different models and measurements, indicating the quality and accuracy of our data and methods.

4.6.2. Impact of ROA on Risk Disclosure and Readability

To further investigate the relationship between risk disclosure and readability, we employed a subsampling technique based on Return on Assets (ROA). Table 9 presents the results, with Model 1 reflecting profitable firms (positive ROA) and Model 2 representing loss-making firms (ROA of zero or less). This approach provides deeper insights into the role of risk disclosure, particularly during the COVID-19 pandemic. The OLS regression analysis reveals a positive and significant relationship between risk disclosure levels (RDL) and readability for profitable firms, as indicated by a coefficient of 0.856. This suggests that these firms benefit from clear communication of their risks. Conversely, for firms with negative ROA, the relationship is not significant, with a coefficient of -0.503 , indicating that risk disclosures may not enhance readability for underperforming firms. By separating the sample based on ROA, we highlight the differing impacts of risk disclosure on firms with varying financial health. This distinction informs stakeholders of the need for tailored risk communication strategies based on a firm's performance level. Moreover, it strengthens the robustness of our findings by ensuring that overall results are not skewed by underperforming firms that may disclose risks less effectively. This analysis reinforces our primary conclusion that higher levels of risk disclosure positively correlate with readability, particularly for profitable firms. It emphasizes the critical importance of effective risk communication in building stakeholder trust and supporting informed decision-making, especially in the context of the challenges posed by the COVID-19 pandemic.

Table 9. Comparative Impact of risk disclosure on readability among profitable and non-profitable firms.

Variables	Profitable	Non-Profitable
	Readability	Readability
RDL	0.856 ** (0.443)	-0.503 (0.474)
FSIZE	0.382 ** (1.424)	0.148 * (1.406)
LIQ	-0.191 (1.481)	-1.410 (0.931)
ROA	17.61 ** (22.29)	1.068 (22.64)
LEV	-9.193 (9.999)	11.70 (10.88)
BSIZE	-1.043 ** (0.943)	-1.813 * (0.976)
INDB	0.188 (0.143)	-0.103 (0.126)
ACNEX	-0.098 (0.191)	-0.166 (0.177)
ACIND	-0.156 (0.131)	0.0666 (0.112)
Constant	30.92 (21.95)	22.48 (24.87)
Observations	395	58
R-squared	0.027	0.138

Standard errors in parentheses. ** $p < 0.05$, * $p < 0.1$.

5. Conclusions

We examined how risk disclosure and readability in UK non-financial firms' annual reports relate during COVID-19. We aimed to answer: How does risk disclosure affect readability? How does COVID-19 disclosure moderate this relationship? How do different risk types influence readability? We used regression models and data from FTSE all share non-financial firms from 2019 to 2021 to test our hypotheses. We found a positive and significant relationship between risk disclosure and readability: firms disclosing more risks have more readable reports. COVID-19 disclosure strengthens this relationship: firms disclosing more COVID-19 and risk information have more readable reports than others. Different risk types have differential effects on readability: COVID-19, credit, operational, and strategic risks positively affect readability, while liquidity, market, and business risks have no effect.

This study's findings have implications for both the theory and practice of risk disclosure and financial communication. This study's findings have implications for both the theory and practice of risk disclosure and financial communication. Theoretically, this study advances the literature on information asymmetry and institutional theory by elucidating the interplay between risk disclosure, readability, and the COVID-19 pandemic. It demonstrates how both external factors, such as the COVID-19 outbreak, and internal factors, including firm characteristics and types of risks, influence risk disclosure and readability. By introducing a new risk definition and category specific to the COVID-19 pandemic, the study enhances existing theoretical frameworks and provides a basis for future research. Furthermore, it develops novel measurements for risk disclosure, encompassing credit, liquidity, market, operational, business, strategic, and COVID-19 risks, thereby advancing methodological approaches in the field. The introduction of a specific COVID-19 risk category contributes to future research by offering a framework that can be utilized in subsequent studies. Methodologically, the research employs a content analysis approach and CFIE software to measure the level of risk disclosure and readability in the annual reports of non-financial firms listed on the FTSE All-Share from 2019 to 2021. This methodology allows for a systematic examination of how different types of risk disclosures impact readability, revealing that COVID-19 risk, credit risk, and strategic risk positively affect readability, while operational risk negatively affects it. The findings provide practical insights for managers, investors, regulators, and standard setters on improving risk disclosure and readability during crises. By emphasizing the importance of clear and comprehensive risk disclosures, the study highlights how firms can enhance stakeholder trust and facilitate informed decision-making.

Practically, the study's findings provide valuable insights for managers, investors, regulators, and standard setters on enhancing the quality and effectiveness of risk disclosure and readability, especially during crises. Clear disclosure of COVID-19-related risks improves readability, reduces information asymmetry, and strengthens stakeholder trust. The study advocates prioritizing relevant and material risk disclosures—such as those related to COVID-19, credit, operational, and strategic risks—while avoiding unnecessary or irrelevant risks like liquidity and market risks, which can detract from overall clarity. Robust risk management frameworks and transparent risk disclosure practices are vital for protecting public health and financial stability during crises.

The findings highlight the critical role of effective risk communication in enhancing a firm's reputation and financial performance. For managers and corporations, prioritizing clear and concise risk disclosures can improve investor confidence, reduce capital costs, and mitigate litigation risks. Aligning risk disclosure practices with broader corporate governance objectives ensures consistency and reliability in financial reporting, fostering long-term stakeholder trust. For investors, readable and informative risk disclosures are crucial for making informed investment decisions. By providing clearer insights into a firm's risk profile, investors can more accurately assess potential returns and risks, leading to improved portfolio diversification and risk management. This clarity is especially important during periods of economic uncertainty, such as the ongoing adjustments in

the post-Brexit UK economy. For regulators and Standard-Setters, the study provides compelling evidence supporting the need for more stringent regulations governing risk disclosure and readability. Policymakers should develop guidelines and standards that promote transparent and understandable financial reporting, including the use of plain language, standardized formats, and visual aids to enhance the accessibility of financial reports for all stakeholders, including non-professional investors. These regulations should also ensure that firms can effectively communicate risks while adhering to practical and beneficial standards for all involved parties. Drawing on best practices from other jurisdictions that have successfully implemented similar guidelines could serve as a useful reference for policymakers.

For academic Researchers, this study contributes to the existing body of knowledge on risk disclosure, readability, and corporate communication, offering a foundation for future research on the evolving landscape of risk management and reporting. Researchers are encouraged to explore emerging challenges such as climate change and technological disruption, where clear communication of risks will continue to be paramount. Future research could investigate how different industries adapt their risk communication strategies in response to regulatory changes, providing further insights into effective risk management practices. The study's results emphasize the need for specific and actionable policy recommendations. Policymakers should focus on developing risk disclosure standards that prioritize transparency and understandability, particularly during crises. These standards should mandate the use of plain language, standardized formats, and visual aids to enhance the accessibility of financial reports for all stakeholders, including non-professional investors. Also, enforcing stricter guidelines for risk reporting—emphasizing clarity and comprehensiveness—will improve transparency in financial markets and support better decision-making during times of crisis.

This study Focusing on UK non-financial firms in the FTSE All Share index may limit generalizability and introduce bias. The study assumes risk disclosure and readability are independent and affected by the same factors, potentially neglecting their interrelation and variation across different pandemic stages. Automated and subjective tools used for risk disclosure and readability may entail errors, biases, or suboptimal levels. The use of purposive sampling and voluntary disclosure may cause non-representativeness or selection effects. Other forms or quality aspects of disclosure that may influence readability and financial communication are not considered. While the 2019–2021 period is deemed essential for understanding immediate responses to the crisis, future research could extend the analysis to include 2022 and beyond, exploring the long-term implications of COVID-19 on risk disclosure practices. Expanding the observation period would provide a more comprehensive understanding of how firms' risk disclosure practices evolve over time, particularly as the pandemic's impact shifts from an acute crisis to a more chronic situation.

This study suggests further research on risk communication and readability during COVID-19. Future studies should use a larger, diverse sample, analyze data longitudinally, explore different types of disclosures and their attributes, and apply advanced text analysis tools. Rigorous indicators should be used to measure risk communication and readability. Random or stratified sampling in a mandatory disclosure setting should be used to minimize selection bias. Extending the observation period to include pre-pandemic (before 2019), during pandemic (2019–2020), and post-pandemic (2021–2023) phases would offer valuable insights into the dynamic nature of risk disclosure practices and their relationship with readability across different stages of the crisis. This study contributes to the literature on risk disclosure, readability, and external factors during COVID-19, and provides practical insights for stakeholders. It calls for continued research to deepen the understanding of risk disclosure and its impact.

The call to action requires firms to enhance risk disclosure, particularly by addressing emerging threats such as pandemics and other potential crises and by communicating this information plainly. While the COVID-19 pandemic has emphasized the importance of disclosing pandemic-related risks, firms should also prioritize the disclosure of other

material risks that could impact their operations and financial performance. A robust risk management framework should encompass the identification, assessment, and communication of a broad range of risks, including but not limited to health crises, natural disasters, regulatory changes, and technological disruptions. Simultaneously, regulators must impose stricter standards for risk reporting and readability, especially in times of uncertainty. These standards should apply to a wide range of risks and not be limited to specific events like the COVID-19 pandemic. By developing comprehensive guidelines for risk disclosure, regulators can ensure that firms are prepared to manage and communicate various types of risks effectively. Proposing a transformative approach, this recommendation suggests mandating firms to disclose material risks in clear language and employ visual elements. This multifaceted initiative, encompassing both corporate and regulatory spheres, aims to elevate the quality and transparency of risk communication, ensuring clarity for investors and other stakeholders, regardless of the nature of the risk. By emphasizing the importance of managing various types of risks, including but not limited to pandemics, this approach emphasizes the need for a proactive and adaptable risk management strategy. Firms should continuously assess their risk profiles, identify emerging threats, and develop strategies to mitigate and communicate these risks effectively. This will not only enhance stakeholder trust but also contribute to the overall resilience and sustainability of the business ecosystem. In light of the COVID-19 pandemic no longer being classified as a public health emergency, it is crucial for firms to apply the lessons learned to future crises. The pandemic has highlighted the importance of robust and adaptable risk management strategies that can address a wide array of potential threats. Firms should not only focus on past crises but also proactively prepare for future events that may pose significant risks to their operations and financial performance.

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Article

Insider Trading before Earnings News: The Role of Executive Pay Disparity

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Abstract: We investigate how executive pay disparity affects insider profits around earnings news. Our findings reveal that high pay disparity is linked to higher abnormal returns from insider purchases before positive news, suggesting insiders exploit good news for greater gains. Conversely, it is associated with lower abnormal returns from insider sales before negative news, indicating less benefit from such sales. These insights highlight the influence of pay disparity on insider trading and underscore the importance of understanding this dynamic to improve decision-making and reduce misuse of insider information.

Keywords: insider gains; CEO pay gap; CEO pay slice; earnings disclosure; good news; bad news

1. Introduction

Insider trading involves the buying or selling of a security by an individual who possesses non-public information about the security. The legality of insider trading hinges on the timing of the trade, and legitimate insiders are obliged to adhere to strict disclosure regulations. This study focuses specifically on lawful insider trading conducted by directors, CEOs, and executive officers who engage in trading their company's shares prior to corporate earnings disclosures.

Lawful insider trading (hereafter insider trading) activities have long been recognized as conveying private information regarding forthcoming earnings, thereby functioning as signals that impact the firm's value (Ball and Brown 1968; Damodaran and Liu 1993; Kraft et al. 2014; Aussenegg et al. 2018; Biggerstaff et al. 2020; Cziraki and Gider 2021). Given that insider trades signal changes in firm value to other market participants, they have a direct impact on share prices and, consequently, the wealth of shareholders. Therefore, understanding the factors that drive insider trading is a crucial and extensively discussed subject in academic literature.

Despite existing research on insider trading, the role of managerial power in pay setting as an explanation for abnormal returns from insider trades prior to earnings announcements has not been examined. Unraveling the relationships between insider trading profits and executive pay disparity is vital for shareholders. This study aims to provide empirical evidence on how pay disparity between the CEO and other top executives influences insiders' ability to profit from their informational advantage.

The executive pay disparity represents the difference in compensation between the highest-ranking executive in a company (typically the CEO) and the average pay of other executives. This pay disparity has been the subject of increasing scrutiny due to concerns about income inequality and its potential consequences. It is believed that a significant executive pay disparity may affect corporate governance, shareholder value, and market

efficiency. According to the managerial power and executive pay hypothesis, a significant wage gap between CEOs and other senior executives can lead to CEOs solidifying their positions and weakening the firm's board (Bebchuk and Fried 2003; Rajan and Wulf 2006; Dai et al. 2016). Consequently, this may result in decreased motivation among other executives, shorter tenures, or an increased likelihood of corporate insider trading. On the contrary, the tournament hypothesis suggests that a substantial disparity in executive compensation acts as a strong incentive to attract other executives to vie for the CEO role. In this scenario, other senior executives possessing the necessary skills to become internal CEO candidates are more inclined to remain with the company in the long run, thereby strengthening the firm's board (Lazear and Rosen 1981; Kale et al. 2009; Schwarz and Severinov 2010). In turn, this may decrease the likelihood of insider trading. As such, the presence of market imperfections, management incentives, and information asymmetry between insiders and investors suggests that executive pay disparity may play a role in insiders' pursuit of trading profits.

We contribute to the literature in two main ways. First, while prior research has focused on executive compensation's impact on performance (Core et al. 1999) or insider trading (Jaffe 1974), more recent studies (Cziraki and Gider 2021) suggest a stronger connection between insider trading gains and firm-specific characteristics. We extend this literature by showing that pay disparity among executives affects insiders' ability to achieve abnormal returns from trades, adding depth to existing theories of compensation's role in corporate governance (Bebchuk et al. 2011). Second, this study introduces a new approach by analyzing market reaction to insider trading before earnings announcements, moderated by pay disparity. Prior research (Jenter 2005) has looked at insider trades and market reactions, but more recent studies (Evgeniou et al. 2022) highlight the timing ability of insiders within firms. We contribute by showing that pay disparity enhances the market's differential response, suggesting that executive compensation structures influence both insiders' actions and market reactions to anticipated earnings news. Overall, this study expands on the understanding of how executive compensation structures—particularly pay disparity—affect insider trading and market dynamics, contributing to a more integrated view of governance, compensation, and market efficiency.

Understanding the link between executive pay disparity and insider trading returns has important implications for a wide range of stakeholders. For corporate governance, it can inform how companies design executive compensation structures to mitigate potential conflicts of interest and reduce the risk of opportunistic insider trading. For policymakers and regulators, these insights can guide the development of frameworks to ensure fairness and transparency in executive pay practices, potentially improving market integrity. Investors, on the other hand, can benefit from recognizing how disparities in executive pay may influence insider behavior, which in turn can affect stock prices and broader market performance. This knowledge can help investors make more informed decisions by understanding how executive pay inequality might signal key dynamics within the firm.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature. Section 3 describes our data sample selection and research methodology. Section 4 discusses our empirical results and findings from the event study and baseline multivariate regression. Section 5 presents the results of our robustness tests. Finally, Section 6 provides some conclusions.

2. Theoretical Framework and Hypotheses

We study the effect of executive pay disparity on insider profitability by testing hypotheses based on information asymmetry, managerial power, and tournament competition. Information asymmetries between corporate insiders and investors arise when investors are unable to effectively assess the competence of managers or can only do so at a high cost. The level of information asymmetry within a firm has a direct impact on the credibility of earnings news, making corporate disclosures crucial in this regard. An extensive empirical literature highlights the finding that corporate insiders consistently outperform the broader

market, indicating that insider trading can serve as a valuable signal containing early information about earnings for investors (Cohen et al. 2012; Aitken et al. 2015; Hillier et al. 2015; Choi et al. 2023).

The managerial power and executive pay hypothesis suggest that a higher executive pay disparity is associated with larger insider trading returns. This relationship can be attributed to lower board quality and the increased likelihood of non-CEO executives relying more on income from insider trading. Bebchuk and Fried (2003), Adams et al. (2005), Chen et al. (2013), and Le et al. (2022) provide evidence that a high CEO pay slice is connected to CEO entrenchment. A significant CEO pay slice indicates an entrenched CEO and weak board quality, which can lead to a breakdown in good governance. Strier (2010) argues that higher pay packages result from poor corporate governance, leading to inadequate investor protection.

Additionally, a lack of promotion opportunities often results in non-CEO senior executives earning lower compensation relative to the CEO, which can drive them to seek alternative income sources, such as insider trading. Bebchuk and Fried (2003) highlight how CEOs have greater control over their own compensation, often leading to a disparity in pay between the CEO and other top executives. This disparity is reinforced by the lack of career advancement opportunities for non-CEO executives, who do not benefit from the same level of influence over compensation decisions. As these executives find themselves stagnating in their roles with limited prospects for promotion, they become increasingly dependent on other forms of income to compensate their lower salaries. The study suggests that limited promotion opportunities and the resulting compensation gap may push non-CEO executives toward risky or unethical financial practices such as insider trading to bridge their income disparity.

Furthermore, several researchers have suggested that weaker boards are associated with lower investor protection and an increase in insider returns (LaPorta et al. 1997, 2000). In line with this, Dai et al. (2016) find that poor corporate governance contributes to higher insider sale returns.

Building upon the above discussion, we propose the following hypothesis:

Hypothesis 1 (H1). *There is a positive relationship between executive pay disparity and corporate insider returns.*

While the managerial power and executive pay hypothesis predict that executive pay disparity may contribute to potential agency problems, the tournament hypothesis views this pay disparity as a remedy for agency problems. A high executive pay disparity represents a stronger incentive for individuals competing for the CEO position (Lambert et al. 1993; Main et al. 1995; Bebchuk and Fried 2003; Kale et al. 2009). In the CEO promotion tournament, contestants require firm-specific skills that are less beneficial if senior executives do not intend to stay in the firm for long. This dynamic helps build a pool of high-quality internal CEO candidates, increases investor protection, and discourages opportunistic behavior (Masulis and Mobbs 2011; Schwarz and Severinov 2010; Ali and Hirshleifer 2017). Consequently, if the tournament hypothesis dominates, there should be a lower level of insider returns. Therefore, we propose our second hypothesis:

Hypothesis 2 (H2). *The executive pay disparity is negatively associated with insider abnormal returns.*

3. Data and Variables

3.1. Sample Construction

Table 1 presents key characteristics of our sample, including the number of firms, market capitalization, and their respective shares in total market values. Our study analyzes earnings announcements from the 340 largest non-financial firms listed on major indices in eight developed markets: US (DJIA), UK (FTSE100), Australia (ASX50), Canada

(TSX60), Germany (DAX), France (CAC40), Belgium (BEL20), and the Netherlands (AEX). These markets have strong corporate governance, investor protection, and legislation in place to safeguard shareholders against accounting errors and fraudulent practices (e.g., Sarbanes–Oxley Act or equivalent measures). The selected firms represent 60.75% of the total market capitalization in these countries. This selection ensures that our dataset is both extensive and diverse, covering a significant portion of the world’s most active and liquid financial markets. These developed markets provide a comprehensive view of insider trading behavior in a broad, high capitalization context, which is crucial for studying the relationship between executive pay disparity and insider trading returns.

Table 1. Sample distribution.

Country	Index	Number of Firms	Market Cap (Trillion USD)	Representation of the Market
U.K.	FTSE100	92	5.678	62.24%
U.S.	DJIA	29	1.927	28.35%
Australia	ASX50	50	1.219	51.50%
Canada	TSX60	59	1.62	72.26%
Germany	DAX	30	1.094	58.53%
France	CAC40	36	1.351	67.28%
Belgium	BEL20	19	0.429	66.31%
Netherlands	AEX	25	0.575	79.53%
Total = 340			Average = 60.75%	

Source: Bloomberg—data collected for the period 2008–2019.

Our study covers the period from 2008 to 2019, prior to the pandemic. We chose to start in 2008 for two reasons. Firstly, data before 2008 is less comprehensive and consistent. Secondly, the 2008 financial crisis led to increased scrutiny of insider behavior and stricter regulations. By examining this period, we gain insights into insider behavior and potential changes in corporate governance and regulation that may have been prompted by the crisis.

Our data were collected from various databases. Insider transaction information, actual earnings, earnings forecasts, insider trading volume, and the number of trading insiders were obtained from the Bloomberg database. Insider transactions are transactions from executives and directors, who hold positions that give them access to non-public information about the company and are required to disclose their trades in the company’s securities to regulatory authorities. Stock prices, earnings disclosure events, and accounting information were sourced from Refinitiv DataStream. Executive pay data were manually collected from the annual reports of the firms in our sample. It is worth noting that our sample only includes CEOs with at least one year of tenure in their respective firms.

We focus on insider open-market purchases and sales of shares, excluding share grants and option exercises, in line with prior studies (Gebka et al. 2017; Jeng et al. 2003; Lakonishok and Lee 2001). Our analysis specifically examines insider trades that occur before the earnings announcement, considering the fifty-day period leading up to it as the pre-announcement period. This event window captures the time between board meeting preparations and the public announcement of earnings. In fact, insiders take advantage of the upcoming good earnings news by buying instead of selling. Therefore, instances of selling before the good news may be attributed to liquidity-related factors. Similarly, insider purchases before the bad earnings news may be a result of a liquidity surplus. As such, our dataset for Buy/Good news events only includes cases where the earnings surprise is equal to or greater than zero, while our Sell/Bad news dataset consists of events with a negative earnings surprise.

During this study period, we collected a total of 3475 insider trading events occurring before earnings announcements out of 9052 earnings disclosures and 25,820 insider

transactions recorded during the period studied. Our data consists of 1311 purchases and 2164 sales. The data coverage details can be found in Table 2. Canada, the USA, and Australia had the highest number of insider transactions prior to earnings disclosures, with Canada leading in both purchases and sales. In contrast, the USA had 18 insider purchases and 481 insider sales. Germany had the smallest number of insider sales at 37 transactions, while insider purchases were roughly three times higher at 117 transactions. On average, insiders conducted their trades well ahead of the announcement dates, with an average of 25.35 days for purchases and 26.2 days for sales.

Table 2. Insider trading—Open market share purchase and sale transactions.

Country	Stock Indices	No. of Firms	All Insider Transactions	No. of Insider Transactions Prior to Disclosures			Average Days Prior to Disclosures	
				Total	Purchases	Sales	Purchases	Sales
United Kingdom	FTSE100	92	4233	239	139	100	26.58	30.91
United States	DOW30	29	3964	499	18	481	26.33	23.91
Canada	TSX60	59	9612	1634	645	989	25.75	28.09
Australia	ASX50	50	3245	459	257	202	21.77	19.43
Germany	DAX	30	1151	154	117	37	28.11	27.19
France	CAC40	36	1742	151	72	79	29.05	30.06
The Netherlands	AEX	25	686	127	27	100	15.07	24.76
Belgium	BEL20	19	1187	212	36	176	29.08	25.84
Total		340	25,820	3475	1311	2164	25.35	26.2

Source: Bloomberg—data collected for the period 2008–2019.

3.2. Empirical Design and Variables

Since it is not feasible to calculate the actual insider return without access to detailed account-level transaction information such as price and volume, researchers measure insider returns by comparing the performance of trades executed by corporate insiders with a benchmark or market index. In line with established practices in the literature, we employ the market model and event study method to assess the abnormal returns of insider transactions, as outlined by Brown and Warner (1985), MacKinlay (1997), and subsequent authors.

In our analysis, the event date is considered as the date when the insiders conduct their trades, denoted as $t = 0$. We compute insider abnormal returns over various event windows, including the $t + 5$ [0–5], $t + 10$ [0–10], $t + 20$ [0–20], $t + 30$ [0–30], $t + 40$ [0–40], and $t + 50$ [0–50] day periods. The abnormal return AR_{it} for firm I on day t is defined as follows:

$$AR_{it} = [R_{it} - (\alpha + \beta_i MR_t)] \times \theta \quad (1)$$

where R_{it} represents the actual insider returns of firm I on day t , and MR_t represents the market return on day t . The parameter θ denotes the direction of the trade, taking the value of +1 if the trade is a “Buy” and -1 if it is a “Sell”. It is important to note that insider sales result in abnormal profits when the share price decreases. Therefore, the abnormal returns are multiplied by -1 to measure the insider gains. To assess the market response to the events, the cumulative abnormal returns, CARs, are calculated for each company for different time windows and tested for normal distribution.

Next, we conduct a regression analysis to examine the relationship between the cumulative abnormal returns of insiders and executive pay disparity. Our multivariate analysis exhibits the following characteristics:

Earnings surprise proxy model

$$\begin{aligned} CAR = & \beta_0 + \beta_1 SURPRISE + \beta_2 CEOGAP_{-1} + \beta_3 ACCRUALS + \beta_4 TRADINGVOL + \\ & + \beta_5 OCFPS_{-1} + \beta_6 FIRMSIZE + \beta_7 MB + \beta_8 LEVERAGE_{-1} + \\ & + \beta_9 RETVOL + \beta_{10} \Delta\_RETVOL + \epsilon i \end{aligned} \quad (2)$$

Change in actual earnings proxy model

$$CAR = \beta_0 + \beta_1 ChgEARNINGS + \beta_2 CEOGAP_{-1} + \beta_3 ACCRUALS + \beta_4 TRADINGVOL + \beta_5 OCFPS_{-1} + \beta_6 FIRMSIZE + \beta_7 MB + \beta_8 LEVERAGE_{-1} + \beta_9 RETVOL + \beta_{10} \Delta\_RETVOL + \epsilon_i \quad (3)$$

where, CAR_i represents the cumulative abnormal returns of transaction I prior to earnings announcements, calculated over various event windows as described earlier. The key variables in our analysis are as follows:

- $CEOGAP_{-1}$ is the CEO pay gap, proxied for executive pay disparity, calculated as the difference between total CEO pay and the mean pay of the other top four executives in the previous year, divided by the total pay of the top five executives, following Bebchuk et al. (2011).
- $SURPRISE$ is the earnings surprise, calculated as the difference between actual and expected earnings divided by actual earnings.
- $ChgEARNINGS$ is the change in earnings per share between year t and year $t - 1$, divided by earnings per share in year $t - 1$.
- $TRADINGVOL$ is insider trading volume, measured as the natural logarithm of the trading volume conducted by insiders.
- $ACCRUALS$ are abnormal accruals, measured using the Jones (1991) model. Accruals are commonly used for earnings smoothing purposes and insider self-trading interests, as shown in previous studies (Agarwal et al. 2007; Aboody et al. 2005; Sawicki and Shrestha 2012; Chowdhury et al. 2017). Consistent with the mainstream literature, we employ accruals as a measure of earnings management.

Following the mainstream literature, we include control variables to account for firm-specific characteristics in our regression model, as used by Agrawal and Cooper (2015), Jenter (2005), Agarwal and Samwick (1999, 2003), and Jin (2002).

- $OCFPS_{-1}$ is operating cash flow per share in the previous year, which serves as our proxy for financial liquidity.
- $FIRMSIZE$ is the natural logarithm of market capitalization, representing firm size.
- BM is book-to-market ratio, calculated as the book value divided by the market capitalization.
- $LEVERAGE_{-1}$ is the ratio of total debt over total assets in the previous year, capturing the firm's leverage.
- $RETVOL$ is stock return volatility, measured as the standard deviation of stock returns for the 250 to 126 days leading up to the insider trading events.
- Δ_RETVOL is the change in stock return volatility, obtained by subtracting $RETVOL$ from the standard deviation of the firm's daily stock returns for the 125 days to 1 day prior to the insider trading events.

We repeat our empirical analysis using the CEO pay slice CPS_{-1} , which is computed as the total CEO pay divided by the total pay of the top five executives in the previous year.

Earnings surprise proxy model

$$CAR = \beta_0 + \beta_1 CPS_{-1} + \beta_2 SURPRISE + \gamma [\text{Controls}] + \epsilon_i \quad (4)$$

Changes in actual earnings proxy model

$$CAR = \beta_0 + \beta_1 CPS_{-1} + \beta_2 ChgEARNINGS + \gamma [\text{Controls}] + \epsilon_i \quad (5)$$

where CAR_i represents the cumulative abnormal returns of transaction I prior to earnings announcements measured over various event windows, and CPS_{-1} is the ratio of total CEO pay divided by the total pay of the top five executives in the previous year. We included control variables as described in Equations (2) and (3). To account for country-specific effects, we adjusted our standard errors for eight clusters corresponding to the countries.

4. Empirical Results

4.1. Descriptive Statistics

Table 3 displays the descriptive statistics of our sample set. In Panel A, the mean cumulative abnormal returns (CARs) show an increasing trend as the event periods expand. For the Buy sample, the mean CAR is 0.209% for the [0 to 5] period, rising to 1.284% for the [0 to 50] period. Similarly, for the Sell sample, the mean insider returns are 0.13% for the [0 to 5] period, increasing to 1.66% for the [0 to 50] period. These results indicate a positive market reaction to insider purchases and a negative reaction to insider sales as the event windows widen. On average, the cumulative abnormal returns of insider sales surpass those of the buy sample, suggesting a stronger market response to insider sales compared to insider purchases.

Table 3. Descriptive Statistics.

Panel (A): Insiders Cumulative Abnormal Returns									
CAR [Event Period]	Buy Sample			Sell Sample			Full Sample		Total Obs.
	N	Mean	St. Dev.	N	Mean	St. Dev.	Min	Max	
(%)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CAR [0 to 5]	1311	0.209	5.77	2164	0.130	4.80	−35.69	57.94	3475
CAR [0 to 10]	1311	0.369	7.20	2164	0.429	6.88	−52.11	50.32	3475
CAR [0 to 20]	1311	0.689	11.14	2164	0.817	10.16	−93.02	86.07	3475
CAR [0 to 30]	1311	0.912	15.74	2164	1.223	13.56	−113.20	139.65	3475
CAR [0 to 40]	1311	1.061	18.24	2164	1.426	15.72	−143.24	183.11	3475
CAR [0 to 50]	1311	1.284	20.02	2164	1.660	17.63	−199.05	198.86	3475
Panel (B): Independent Variables									
	Buy Sample			Sell Sample			Full Sample		Total Obs.
	N	Mean	St. Dev.	N	Mean	St. Dev.	Min	Max	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SURPRISE (%)	1194	13.09	86.77	1995	7.16	61.67	−433.30	865.9	3189
ChgEARNINGS (%)	1256	−0.21	74.71	2050	11.40	76.68	−440.0	500.0	3306
CEOGAP	934	0.20	0.11	1607	0.17	0.15	−0.20	0.66	2541
ACCRUALS	1301	0.01	0.07	2135	0.009	0.063	−0.80	0.37	3166
BUY (1,000 shares)	1309	896.30	4733.8				1	81,654	1309
SELL (1,000 shares)				2162	369.80	2903.2	1	75,893	2162
OCFPS (in US\$)	1288	1.12	3.43	2137	1.55	3.90	−38.08	47.13	3425
FIRMSIZE (in million US\$)	1253	20,868	28,796	2095	57,988	96,293	215.40	647,361	3348
MB	1238	2.89	9.51	2063	3.28	4.34	0.19	315.6	3301
LEVERAGE (%)	1253	26.75	15.02	2082	21.59	14.82	0.000	93.70	3335
RETVOL (%)	1309	1.96	1.05	2162	2.05	1.27	0.43	9.45	3471
Δ_RETVOL (%)	1309	−0.07	1.03	2162	0.12	1.04	−5.95	5.26	3471

Notes: This table reports descriptive statistics for a sample of 1311 purchases and 2164 sales traded by officers and directors between 2008 and 2019. Panel (A) presents a summary of CARs in 6 event periods; Panel (B) reports summary statistics of the independent variables. *SURPRISE* is earning surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earning *ChgEARNINGS* is the change between earning per share for year t and year $t - 1$ divided by earning per share year $t - 1$. *CEOGAP* is the CEO gap ratio, measured as the difference between the total CEO pay and the mean of other four executives' pay divided by the total pay of the top five executives; *ACCRUALS* is abnormal accrual measured using a modified version of the Jones (1991) model. Insiders' buying/selling volume *BUY/SELL* is the purchase/sale volume made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the total market capitalization of a firm. Market to book value *MB* is the book value divided by the total market capitalization of a stock. Financial leverage *LEVERAGE* _{$t-1$} is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days $[-250, -126]$ relative to the insider trading day. The change in standard deviation Δ_RETVOL equals the standard deviation of the firm's daily stock returns computed over trading days $[-125, -1]$ relative to the insider trading day minus *RETVOL*.

Panel B summarizes the 12 independent variables. Notably, purchase transactions have a higher average earnings surprise (*SURPRISE*) of 13.09% compared to the Sell sample's average of 7.16%. Conversely, the average change in earnings (*ChgEARNINGS*) is larger for the Sell sample at 11.40% compared to the Buy sample's average of −0.21%. This difference stems from variations between analysts' expectations and actual earnings. The CEO pay gap ratio ranges from −20% to 66%, with negative values indicating lower CEO compensation than the average of the other executives. Purchase transactions have an average insider dealing volume of 869.3 thousand shares, while sales have an average of 369.8 thousand shares. The Buy sample's mean market capitalization is \$20.868 billion, while the Sell sample's is approximately \$57.988 billion, suggesting that insider purchases are more common in smaller firms, while insider sales are more prevalent in larger firms.

Table 4 shows the results of the test for normal distribution of cumulative abnormal returns (*CARs*) in different event periods. *CARs* are significantly different from 0 in most event periods, indicating a significant insider gain over the broader market. The average *CARs* for the Sell/Bad news sample gradually increase from 0.492% to 3.856% for the [0 to 5] and [0 to 50] event periods, respectively, and are highly significant. These values are also significantly higher than the *CARs* for the purchase/good news sample, ranging from 0.258% to 3.363% for the same event periods. Notably, the difference between Buy for good news and Sell for bad news events is significant for the [0 to 10], [0 to 20], and [0 to 30] event windows, indicating a higher level of information asymmetry surrounding bad news compared to good news.

Table 4. *CARs* of insider trading activities in different event periods.

Panel (A): Buy and Sell Activities for the Whole Sample					
Event Period	Buy		Sell		Mean Difference Test
	Total Sample (N = 1311)		Total Sample (N = 2164)		t-Value
	CAR	t-Value	CAR	t-Value	
[0 to 5]	0.209	1.38	0.13	1.31	0.413
[0 to 10]	0.369	1.87 *	0.429	3.11 **	−0.24
[0 to 20]	0.689	2.27 **	0.817	4.33 ***	−0.33
[0 to 30]	0.912	2.07 *	1.223	4.81 ***	−0.59
[0 to 40]	1.061	2.08 *	1.426	4.80 ***	−0.60
[0 to 50]	1.284	2.30 **	1.66	4.95 ***	−5.60
Panel (B): Buy in Good News and Sell in Bad News					
Event Period	Buy (Positive Earnings Surprise)		Sell (Negative Earnings Surprise)		Mean Difference Test
	Total Sample (N = 743)		Total Sample (N = 631)		t-Value
	CAR	t-Value	CAR	t-Value	
[0 to 5]	0.258	1.10	0.492	2.42 **	−0.76
[0 to 10]	0.419	1.49	1.263	4.69 ***	−2.17 **
[0 to 20]	1.611	3.66 **	3.115	7.55 ***	−2.49 **
[0 to 30]	2.740	4.41 ***	4.144	8.35 ***	−1.76 *
[0 to 40]	2.989	4.20 ***	3.522	6.42 ***	−0.59
[0 to 50]	3.363	4.32 ***	3.856	5.68 ***	−0.47

Notes: Panel (A) presents the cumulative abnormal returns *CARs* of insiders for the whole Buy/Sell activities. Panel (B) reports the cumulative abnormal returns *CARs* of insider buy in the Good news and sell in the Bad news. The mean difference test shows the t-value of the mean *CAR* difference between Insider buys and Insider sells. A positive or negative value the difference test indicates that there is a higher or lower value for Buy Sample than that for Sell Sample. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Figure 1 illustrates the variation of insider abnormal returns across different event windows (0 to 50 days). In the initial 20-day window, there is a slight disparity between the average abnormal returns (*AARs*) of buying and selling transactions. However, from day 20 to day 50, the market shows a significantly stronger reaction to insider selling transactions compared to insider buying transactions.

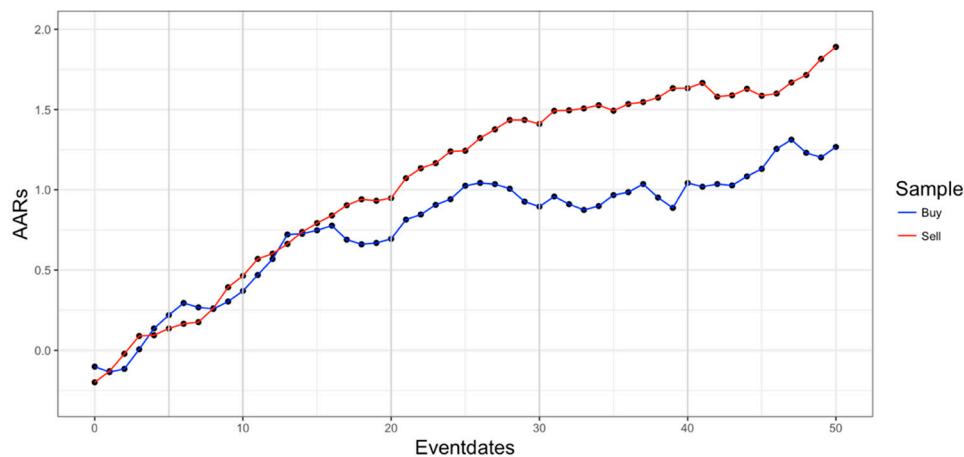


Figure 1. Average Insider Abnormal Returns for Buy and Sell Samples over 50 days.

Figures 2 and 3 display the correlation coefficients among the variables within the Buy and Sell samples, respectively. In Figure 2, we observe a significant and positive correlation between *SURPRISE* and *CAR*, indicating a positive association between earnings surprise and insider purchase returns. Additionally, we note a significant and negative correlation between Δ_RETVOL and *CAR*, suggesting that a decrease in equity risk leads to higher returns in insider purchase activities. In contrast, Figure 3 illustrates a negative relationship between *SURPRISE* and *CAR*, indicating a negative association between earnings surprise and insider sale returns. Moreover, we observe a positive relationship between Δ_RETVOL and *CAR*, implying that an increase in equity risk influences changes in managers' holdings through stock sales. Both figures demonstrate low correlation coefficients, which mitigates concerns related to multicollinearity that could potentially have affected our regression results.

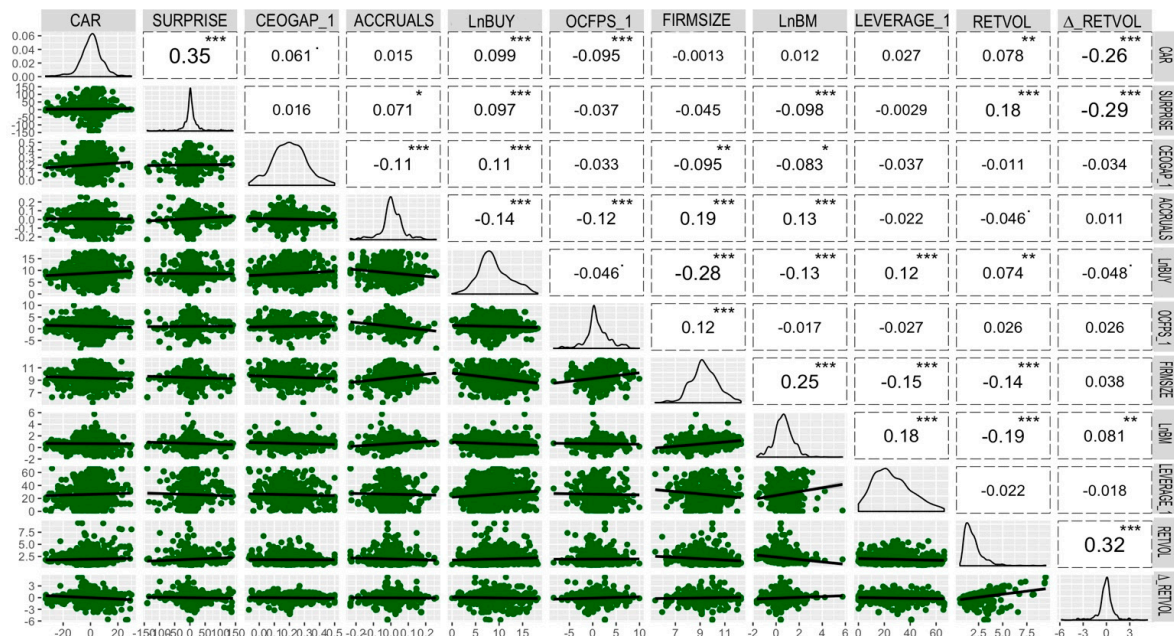


Figure 2. Correlation Matrix of Independent Variables—Purchase Sample. (* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$).

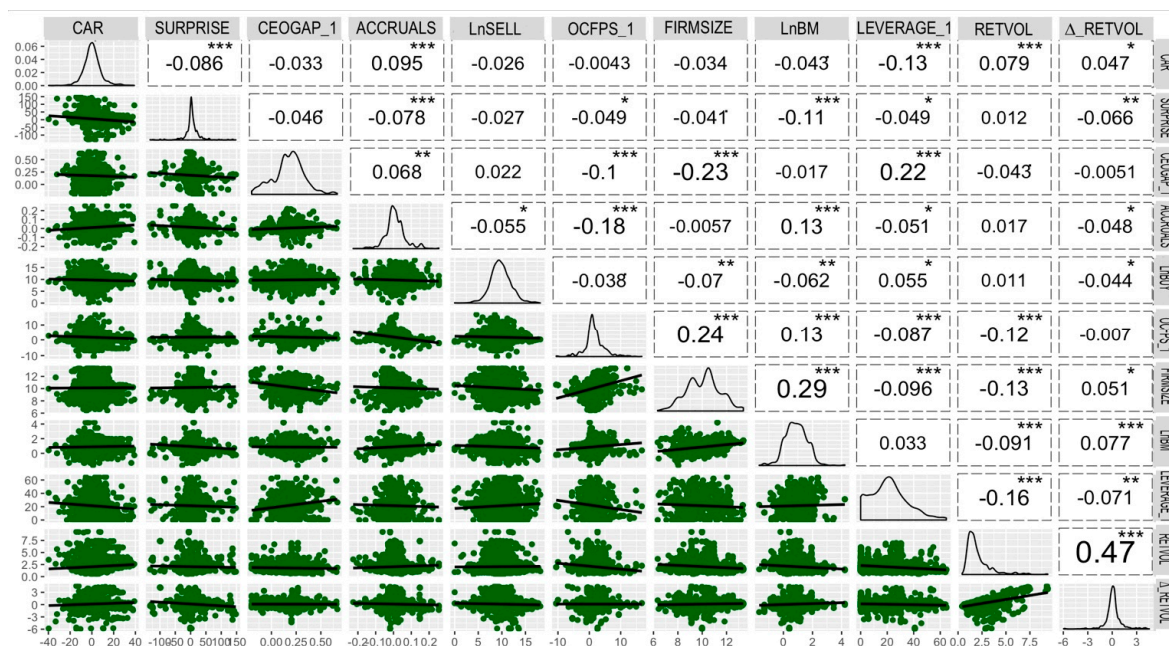


Figure 3. Correlation Matrix of Independent Variables—Sale Sample. (* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$).

4.2. Main Models

We analyze the relationship between insider cumulative abnormal returns in different event periods and two key variables: CEO pay gap and earnings surprises. The regression results are presented in Tables 5 and 6. In both tables, columns (1) to (6) show the regression results for CARs in the event periods and other independent variables, using earnings surprise (*SURPRISE*) as a proxy for earnings changes. Columns (7) to (12) use changes in actual earnings (*ChgEARNINGS*) as a proxy. The models also include controls for firm-level factors and stock risks.

Table 5 presents regression results for the Buy/Good news sample, showing significant positive relationships between insider trading returns (CARs) and earnings proxies. These findings confirm insider trading as a signal for future earnings, with insider buying returns positively linked to changes in the firm's earnings. Notably, CARs in columns (2) to (6) exhibit a strong positive relationship with earnings surprises. The coefficient for the 40-day window is particularly significant, indicating a 7.7% increase in insider abnormal returns for every 1% rise in earnings surprise. However, the coefficient for the [0 to 5] event period is insignificant, suggesting no significant relationship between earnings surprise and CAR [0–5]. Using *ChgEARNINGS* as a proxy for actual earnings changes, we find a significant positive relationship between earnings surprises and CARs in columns (10), (11), and (12). However, in column (8) alone, the coefficient is negative and significant at the 10% level, indicating that a 1% increase in insider returns for the first 10 days after their purchases predicts a 0.5% decrease in earnings changes. Overall, the coefficients of *SURPRISE* in the Buy sample are higher than those of *ChgEARNINGS*, suggesting that insiders rely more on earnings surprise information than changes in earnings. The coefficients of *SURPRISE* and *ChgEARNINGS* in the 10-day window columns are relatively small (0.008 and -0.005 , respectively), indicating that insider cumulative abnormal returns for 10-day windows may not reliably signal upcoming earnings information. However, the coefficient of *SURPRISE* significantly increases for the 20-day window (0.038) and the 40-day window (0.077), suggesting that firms “leak” earnings news earlier relative to the 20-day window.

Table 5. Determinants of insider gains, main regression—Buy before the Good news disclosures.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0-10] (2)	CAR [0-20] (3)	CAR [0-30] (4)	CAR [0-40] (5)	CAR [0-50] (6)	CAR [0-5] (7)	CAR [0-10] (8)	CAR [0-20] (9)	CAR [0-30] (10)	CAR [0-40] (11)	CAR [0-50] (12)
SURPRISE	0.004 (0.187)	0.008 (0.008)	0.038 (0.000)	0.073 (0.000)	0.077 (0.000)	0.074 (0.000)	-0.002 (0.456)	-0.005 (0.051)	0.005 (0.155)	0.012 (0.012)	0.012 (0.024)	0.010 (0.074)
ChgEARNINGS												
CEOGAP ₋₁	2.364 (0.218)	3.919 (0.078)	6.695 (0.020)	7.737 (0.036)	8.348 (0.043)	12.697 (0.004)	2.07 (0.260)	2.773 (0.197)	4.404 (0.133)	3.783 (0.338)	3.89 (0.372)	8.668 (0.054)
CEOGAP ₋₁ *SURPRISE	0.042 (0.218)	0.175 (0.000)	0.284 (0.000)	0.393 (0.000)	0.422 (0.000)	0.422 (0.000)						
CEOGAP ₋₁ *ChgEARNINGS												
ACCRUALS	2.747 (0.391)	7.186 (0.053)	12.258 (0.011)	16.132 (0.009)	10.672 (0.120)	18.042 (0.013)	3.114 (0.317)	8.141 (0.026)	17.746 (0.000)	27.693 (0.000)	22.886 (0.002)	30.345 (0.000)
LnBUY	-0.000 (0.996)	0.043 (0.558)	0.260 (0.007)	0.370 (0.003)	0.451 (0.002)	0.445 (0.002)	0.017 (0.790)	0.063 (0.389)	0.298 (0.003)	0.427 (0.002)	0.501 (0.001)	0.483 (0.002)
OCFPS ₋₁	-0.013 (0.842)	-0.018 (0.805)	-0.256 (0.009)	-0.326 (0.009)	-0.296 (0.033)	-0.215 (0.138)	-0.039 (0.485)	-0.057 (0.380)	-0.309 (0.001)	-0.487 (0.000)	-0.468 (0.000)	-0.421 (0.003)
FIRMSIZE	0.095 (0.668)	0.012 (0.962)	0.411 (0.217)	0.244 (0.566)	0.271 (0.569)	0.438 (0.380)	0.17 (0.425)	0.103 (0.679)	0.559 (0.100)	0.482 (0.292)	0.585 (0.247)	0.781 (0.133)
LnMB	-0.076 (0.793)	-0.05 (0.882)	0.51 (0.237)	1.067 (0.053)	1.334 (0.031)	1.744 (0.008)	-0.063 (0.818)	0.004 (0.991)	0.424 (0.331)	0.961 (0.102)	1.187 (0.068)	1.672 (0.013)
LEVERAGE ₋₁	0.045 (0.002)	0.052 (0.002)	0.066 (0.003)	0.039 (0.156)	0.043 (0.167)	0.042 (0.202)	0.044 (0.002)	0.048 (0.004)	0.062 (0.007)	0.036 (0.239)	0.039 (0.246)	0.037 (0.278)
RETVOL	0.415 (0.142)	0.522 (0.111)	1.386 (0.002)	1.815 (0.001)	3.289 (0.000)	4.038 (0.000)	0.675 (0.010)	0.958 (0.002)	2.879 (0.000)	5.067 (0.000)	6.711 (0.000)	7.590 (0.000)
Δ RETVOL	-1.328*** (0.001)	-1.825*** (0.000)	-4.179*** (0.000)	-4.844*** (0.000)	-5.391*** (0.000)	-6.197*** (0.000)	-1.778*** (0.000)	-2.443*** (0.000)	-6.175*** (0.000)	-8.853*** (0.000)	-9.708*** (0.000)	-10.494*** (0.000)
Constant	-3.171 (0.196)	-3.527 (0.215)	-11.832*** (0.002)	-11.998** (0.011)	-15.918*** (0.003)	-20.186*** (0.000)	-4.324* (0.068)	-4.874* (0.079)	-15.222*** (0.000)	-18.836*** (0.000)	-23.542*** (0.000)	-28.321*** (0.000)
Observations	832	832	832	832	832	832	843	843	843	843	843	843
Adjusted R ²	0.052	0.100	0.356	0.443	0.434	0.433	0.065	0.092	0.268	0.304	0.313	0.338

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR* (*event period*); *SURPRISE* is earning surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year *t* and year *t* − 1 divided by earnings per share year *t* − 1. *CEOGAP*_{−1} is the CEO gap ratio of year *t* − 1, measured as the difference between the total CEO pay and the mean of other four executives' pay divided by the total pay of the top five executives; *CEOGAP*_{−1} * *SURPRISE* is the interactive variable between *CEOGAP*_{−1} and *SURPRISE*; *CEOGAP*_{−1} * *ChgEARNINGS* is the interactive variable between *CEOGAP*_{−1} and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using a modified version of the Jones (1991) model. Insiders' trading volume *LnBUY* is the natural logarithm of the purchasing volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market-to-book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE*_{−1} is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation $\Delta RETVOL$ equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. The *p*-values are shown below the estimates in parentheses (). * *p* < 0.05; ** *p* < 0.01; *** *p* < 0.001.

Table 6. Determinants of insider gains, main regression—Sell before Bad News disclosures.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0–10] (2)	CAR [0–20] (3)	CAR [0–30] (4)	CAR [0–40] (5)	CAR [0–50] (6)	CAR [0–5] (7)	CAR [0–10] (8)	CAR [0–20] (9)	CAR [0–30] (10)	CAR [0–40] (11)	CAR [0–50] (12)
SURPRISE	0.001 (0.645)	−0.006 * (0.065)	−0.002 (0.583)	−0.016 *** (0.003)	−0.010 * (0.087)	−0.009 (0.206)						
ChgEARNINGS							0.001 (0.445)	0.002 (0.284)	0.002 (0.395)	0.003 (0.376)	−0.0003 (0.942)	−0.002 (0.652)
CEOGAP _{−1}	−0.186 (0.786)	−0.751 (0.414)	−2.544 ** (0.043)	−4.049 *** (0.009)	−3.450 ** (0.049)	−5.239 (0.011)	−0.429 (0.510)	−1.068 (0.244)	−2.811 ** (0.035)	−4.004 ** (0.014)	−3.079 * (0.084)	−4.782 ** (0.022)
CEOGAP _{−1} *SURPRISE	−0.057** (0.013)	−0.034 (0.273)	−0.045 (0.286)	−0.087 * (0.092)	−0.058 (0.320)	−0.077 (0.258)	**					
CEOGAP _{−1} *ChgEARNINGS							0.015 * (0.088)	0.011 (0.351)	0.021 (0.244)	0.022 (0.300)	−0.002 (0.936)	0.01 (0.723)
ACCRUALS	−6.761*** (0.000)	−7.701 *** (0.002)	−7.844 ** (0.017)	−13.703*** (0.001)	−15.958 *** (0.000)	−12.00 ** (0.025)	−6.879 *** (0.000)	−8.230 *** (0.001)	−7.490 ** (0.030)	−11.993 *** (0.005)	−13.277 *** (0.004)	−9.708 * (0.071)
LnSELL	0.012 (0.804)	−0.042 (0.510)	−0.160 * (0.063)	−0.294 *** (0.006)	−0.257 ** (0.032)	−0.336 (0.017)	−0.035 (0.420)	−0.145 ** (0.020)	−0.377 *** (0.000)	−0.523 *** (0.000)	−0.467 *** (0.000)	−0.563 *** (0.000)
OCFPS _{−1}	0.019 (0.501)	0.018 (0.627)	0.029 (0.571)	0.056 (0.372)	0.08 (0.257)	0.105 (0.205)	0.018 (0.443)	0.003 (0.927)	0.046 (0.351)	0.041 (0.490)	0.08 (0.222)	0.08 (0.297)
FIRMSIZE	−0.215** (0.028)	−0.416 *** (0.002)	−0.452 ** (0.012)	−0.511 ** (0.021)	−0.667 *** (0.008)	−0.654 * (0.025)	−0.262 *** (0.004)	−0.540 *** (0.000)	−0.674 *** (0.000)	−0.696 *** (0.002)	−0.797 *** (0.002)	−0.734 ** (0.011)
LnMB	−0.246 (0.161)	−0.386 (0.102)	−0.753 ** (0.020)	−0.647 (0.103)	−0.317 (0.479)	−0.873 (0.095)	−0.173 (0.273)	−0.172 (0.439)	−0.335 (0.298)	−0.062 (0.875)	0.209 (0.628)	−0.348 (0.489)
LEVERAGE _{−1}	−0.001 (0.897)	−0.01 (0.330)	−0.006 (0.682)	−0.005 (0.794)	−0.014 (0.479)	0.004 (0.878)	−0.006 (0.450)	−0.024 ** (0.030)	−0.024 (0.124)	−0.021 (0.270)	−0.029 (0.176)	−0.015 (0.548)
RETVOL	−0.770*** (0.000)	−1.083 *** (0.000)	−1.688 *** (0.000)	−1.806 *** (0.000)	−1.598 *** (0.000)	−1.947 *** (0.000)	−0.805 *** (0.000)	−1.477 *** (0.000)	−2.457 *** (0.000)	−2.564 *** (0.000)	−2.022 *** (0.000)	−2.652 *** (0.000)
Δ_RETVOL	1.198 *** (0.000)	1.719 *** (0.000)	2.837 *** (0.000)	3.291 *** (0.000)	3.012 *** (0.000)	3.553 *** (0.000)	1.337 *** (0.000)	2.526 *** (0.000)	4.293 *** (0.000)	4.742 *** (0.000)	4.047 *** (0.000)	5.035 *** (0.000)
Constant	3.587 *** (0.004)	7.299 *** (0.000)	10.730 *** (0.000)	13.180 *** (0.000)	14.110 *** (0.000)	16.081 (0.000)	4.644 *** (0.000)	10.313 *** (0.000)	15.982 *** (0.000)	17.855 *** (0.000)	17.487 *** (0.000)	19.678 *** (0.000)
Observations	1353	1353	1353	1353	1353	1353	1405	1405	1405	1405	1405	1405
Adjusted R ²	0.051	0.053	0.07	0.08	0.051	0.048	0.056	0.09	0.119	0.104	0.066	0.071

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR* [event period]; *SURPRISE* is the change between earnings per share for year t and year $t - 1$ divided by earnings divided by actual earnings. The change in earnings *ChgEARNING* is the CEO gap ratio of year $t - 1$, measured as the difference between the total CEO pay and the mean of other four executives' pay divided by the total pay of the top five executives; *CEOGAP_{−1}*SURPRISE* is the interactive variable between *CEOGAP_{−1}* and *SURPRISE*; *CEOGAP_{−1}*ChgEARNINGS* is the interactive variable between *CEOGAP_{−1}* and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using a modified version of the Jones (1991) model. Insiders' trading volume *LnSELL* is the natural logarithm of the selling volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market-to-book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE_{−1}* is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ_RETVOL equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. The p -values are shown below the estimates in parentheses (). * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Next, we analyze the relationship between insider abnormal returns and CEO pay gap. The coefficients of $CEOGAP_{-1}$ in columns (2) to (6) and column (12) are positively and significantly associated with insiders' CARs. This supports our hypothesis H1, suggesting that a larger CEO pay gap encourages corporate insiders to leverage inside information for trades. For example, in column (3), a 1% increase in the CEO pay gap leads to a 6.69% rise in insider abnormal returns for the 20-day event window. The positive and significant impacts of $CEOGAP_{-1}$ and earnings surprise proxies on insider abnormal returns imply that insiders in firms with greater executive pay disparity are more likely to exploit their superior information on earnings through purchases (Bebchuk and Fried 2003; Morse et al. 2011). Furthermore, firms with higher executive pay disparity tend to exhibit higher levels of information asymmetry, which insiders can exploit through strategic timing of trades, particularly around earnings announcements (Cohen et al. 2012). Insiders in firms with greater executive pay disparity may be more motivated to bridge the compensation gap by capitalizing on their knowledge of future earnings. This heightened motivation, coupled with the financial incentives of generating abnormal returns, can drive insiders to engage in more aggressive and strategic trading activities, resulting in positive relationships between the CEO pay gap and insider abnormal returns.

Furthermore, the interaction between CEO pay gap and earnings surprise enhances the impact of earnings surprises on insider profits. The coefficients of the interaction terms in columns (2)–(6) of Table 5 show strong positive and significant relationships with insider abnormal returns. We argue that insiders in firms with a larger CEO pay gap are more likely to capitalize on future earnings surprises for profitable trades. The combined effect of CEO pay gap and earnings surprise amplifies the impact of earnings surprise on insider trading returns. This convergence of factors influences market perception and reactions to insider trading activities. Investors and market participants may interpret the convergence of these factors as a signal of the strength and reliability of the insider information being used. This positive market response further magnifies the effect of the CEO pay gap on insider abnormal returns. Insiders in firms with a larger CEO pay gap show greater ability to shape market perceptions and generate stronger reactions through their trades, resulting in higher abnormal returns.

The positive and significant impacts of the CEO pay gap on insider purchase returns support our hypothesis H1. From a managerial power perspective, several factors contribute to this relationship. Firstly, a large CEO pay gap indicates power concentration and weaker board oversight, which can allow insiders with superior information to exploit this advantage for personal gain, particularly through purchases based on positive earnings news (Bebchuk and Fried 2003; Core et al. 1999). Secondly, firms with larger CEO pay gaps often exhibit characteristics like higher CEO entrenchment and succession risks, which reflect uncertain business environments and potential variations in future performance (Fahlenbrach 2009; Morse et al. 2011). Insiders may time their purchases strategically around positive earnings announcements, leading to higher abnormal returns (Cohen et al. 2012). Thirdly, a larger CEO pay gap may signal a skilled and successful CEO, which can boost investor confidence and attract more investors to the firm. This increased demand for the company's stock can raise the returns on insider purchases (Jenter and Lewellen 2015). Finally, the concentration of decision-making power in the CEO's hands allows for opportunistic behavior, where CEOs can capitalize on positive earnings news for personal gain through insider trading, further driving up insider returns (Bebchuk and Fried 2003; Fahlenbrach 2009).

The signs and significance levels on other control variables align with our expectations and previous research. We find a positive and highly significant association between *ACCRUALS* and insider cumulative abnormal returns in most columns, indicating that insiders actively engage in earnings management for their own benefit, particularly in relation to their stock purchase activities prior to good earnings news (See Aboody et al. 2005; Sawicki and Shrestha 2012; and Chowdhury et al. 2017). Higher levels of accruals indicate a greater degree of earnings management. By leveraging their superior knowledge

of inside information, insiders may manipulate earnings accruals upward, allowing them to engage in buying trades before good earnings announcements and thus profit from their stock purchases.

LnBUY exhibits a positive and significant relationship with insider purchase abnormal returns in columns (3) to (6) and (9) to (12). This suggests that when insiders engage in larger volume stock purchases, it may influence outsiders to imitate their trades, leading to an increase in stock market prices and ultimately improving insider abnormal returns. This observation aligns with Bettis et al. (1997), who highlight that outsiders can achieve significant abnormal returns by replicating insider trades.

We observe a negative and significant relationship between *OCFPS₋₁* and *CARs* in columns (3) to (5) and (9) to (12). This implies that insiders belonging to firms with declining operating cash flows tend to achieve higher returns from their insider purchases. This phenomenon can be explained by several factors. First, insiders have an information advantage, accessing non-public information about the company's financial performance. They time their purchases strategically based on expected recovery or positive developments not yet reflected in the stock price. Second, a decline in operating cash flows can lead to undervaluation of the company's stock, prompting insiders to acquire shares at a discounted price, anticipating future improvements. Third, insiders with a contrarian investment approach may buy shares during periods of negative sentiment when external investors are pessimistic, expecting a future recovery and subsequent increase in stock prices.

The coefficient for *FIRMSIZE* is significant only in column (9) at a 10% level. The coefficient for market-to-book value is significant in columns (4), (5), (6), (11), and (12).

Further, we observe a positive association between *CARs* and *LEVERAGE₋₁* in columns (1) to (3), and (7) to (9). Insiders in companies with higher debt levels in the previous year tend to generate greater abnormal returns.

RETVOL shows a strong positive association with *CARs*, indicating that higher stock return volatility corresponds to greater insider trading returns. However, we also observe a negative relationship between *CARs* and Δ_RETVOL (change in return volatility). This can be interpreted in two ways. Firstly, a decrease in return volatility suggests a more stable market with fewer opportunities for insiders to exploit mispriced securities. As a result, insider trading may yield lower cumulative abnormal returns. Secondly, the negative relationship suggests that insiders may be less successful in generating abnormal returns when market conditions become more predictable. This aligns with previous research by Aggarwal and Samwick (1999, 2003) and Jin (2002).

Table 6 presents the regression model results for the Sell/Bad news sample. In contrast to the Buy/Good news sample, we find negative and statistically significant coefficients for insiders' cumulative abnormal returns (*CARs*) in relation to earnings surprise (*SURPRISE*) in columns (2), (4), and (5). The coefficients indicate that a 1% increase in earnings surprise is associated with a decrease of 0.01%, 0.02%, and 0.01% in *CAR* [0–10], *CAR* [0–30], and *CAR* [0–40], respectively. These findings suggest that insider sellers can achieve higher returns when upcoming earnings fall below expectations. The negative coefficients indicate that insider selling transactions can serve as a signal for a decline in future earnings, allowing insiders to mitigate losses or take advantage of declining stock prices. In columns (7) to (12), we do not find a significant relationship between *CARs* and earnings changes (*ChgEARNING*).

The weaker relationship between insider sale returns prior to bad earnings news and earnings surprises, compared to insider purchase returns prior to good earnings news, can be attributed to several factors. First, information asymmetry: Negative insider information may not be widely known, leading to a delayed market reaction. Second, insider motivations: Selling insiders may have diverse reasons, weakening the relationship. Third, market response: Good news prompts immediate stock price increases, while bad news may have a more muted or delayed reaction. Fourth, timing and reporting: Insiders may have early access to positive information, allowing timely purchases, while bad news may take longer to materialize, leading to delayed sales.

The negative and significant coefficients of $CEOGAP_{-1}$ in multiple columns (3) to (5) and (9) to (12) tends to contradict our hypothesis $H1$ and support the tournament hypothesis ($H2$) in insider selling activities. These coefficients may indicate that a larger CEO pay gap is associated with lower abnormal returns for insiders selling their shares. This finding suggests that a higher CEO pay gap may have a demotivating effect on insiders, reducing their incentive to engage in profitable insider sales (See Lambert et al. 1993; Main et al. 1995; Bebchuk and Fried 2003; and Kale et al. 2009). Conversely, a smaller pay gap between the CEO and other executives may demotivate them from pursuing the CEO position, potentially resulting in lower management quality. In such cases, insiders are more likely to exploit their informational advantages during stock sales, leading to higher insider returns (See Inci 2012; Dai et al. 2016). Taken together these results demonstrate the complex relationship between the CEO pay gap, management quality, and insider returns, highlighting the role of the CEO pay gap in shaping insiders' motivations, trading behavior, and abnormal returns.

The coefficients relating to the interaction between $CEOGAP_{-1}$ and $SURPRISE$ in Table 6 exhibit both negativity and statistical significance in columns (1), (4), and (6). In simpler terms, the combined impact of CEO pay gap and earnings surprise on insider trading consistently demonstrates a negative and statistically significant correlation. This implies that when considering the influence of earnings surprise, the already observed negative and significant relationship between CEO pay gap and insider trading returns is further accentuated.

The coefficients associated with the interaction between $CEOGAP_{-1}$ and $SURPRISE$ in Table 6 are negative and statistically significant in columns (1), (4), and (6). In other words, the joint effect of CEO pay gap and earnings surprise on insider trading is still characterized by a negative and significant association. This suggests that when accounting for the influence of earnings surprise, the negative and significant relationship between the CEO pay gap and insider trading returns is further amplified.

Overall, the negative impacts of the CEO pay gap on insider sale returns suggest that firms with a larger CEO pay gap exhibit characteristics and mechanisms that discourage insiders from engaging in opportunistic behavior and exploiting negative news for personal gain through insider sales. This can be explained by several factors. First, a high CEO pay gap signals a concentration of power and control in the hands of the CEO, leading to greater scrutiny and oversight by the board of directors, making it more challenging for insiders to engage in opportunistic behavior such as selling stocks based on inside information. Consequently, insiders in firms with a high CEO pay gap may be deterred from exploiting bad earnings news for personal gain through insider sales. Second, a high CEO pay gap represents a stronger incentive for individuals competing for the CEO position. The CEO promotion tournament helps to build a pool of high-quality internal CEO candidates, increases investor protection, and discourages opportunistic behavior. This effectively discourages insiders from engaging in fraudulent or manipulative practices, reduces the likelihood of insiders benefiting from insider sales before bad earnings news and leads to lower insider-sale returns. Third, a high CEO pay gap may indicate a higher level of CEO entrenchment and lower succession risk. In such cases, the CEO's interests may align more closely with the long-term success of the company. Insiders, including the CEO, may be more inclined to hold on to their shares instead of selling them, as they anticipate improved future performance and long-term rewards. This reduces selling activity among insiders in firms with a high CEO pay gap and can contribute to lower insider sale returns.

The relationships between insider abnormal returns and the remaining control variables also exhibit significant findings across most cases. Notably, we observe negative coefficients for earnings management $ACCRUALS$ in all columns. The finding that insider sales returns before bad earnings news have a negative relationship with accruals can be attributed to two main factors. Firstly, the market perceives higher accruals as a red flag for lower quality or riskier financial reporting, leading to decreased abnormal returns for insiders. Secondly, higher accruals signal lower financial reporting quality, eroding

investor confidence. Insiders selling stocks in companies with higher accruals may face lower demand or a higher risk premium, resulting in lower returns.

Regarding insider sale trading volume $LnSELL$, we find negative and significant coefficients in columns (3) to (5) and (8) to (12). This indicates that higher insider returns from sales transactions are associated with a decrease in insider trading volume. Several factors may contribute to this pattern. First, insiders with access to more significant and valuable information are more likely to engage in selling when insider trading volume is low. They may possess insider knowledge about negative developments or anticipate poor future prospects for the company. Second, insiders who sell during a period of low insider trading volume can carefully choose the timing and execution of their sales to take advantage of their insights, leading to higher returns compared to average market conditions. With fewer insiders participating in selling activities, the impact of each individual insider's selling is more pronounced. The limited insider selling that occurs during this period tends to attract attention and potentially signals a stronger conviction in their decision to sell. As a result, the sales transactions are more likely to generate higher-than-average returns. In contrast, high insider trading volume involves more insiders selling, diluting the impact of individual activity and resulting in average or lower returns. Increased selling activity may also include insiders selling for reasons other than private information, such as diversification or personal financial needs. There is weak evidence, only column (6), that insider sale returns are associated with the operating cash flow of the bad news firms, at the 5% level of significance. The coefficients of $FIRMSIZE$ display a negative and significant association with $CARs$ in all columns, consistent with the prior literature (Seyhun 1986; Agrawal and Cooper 2015). This implies that larger firms tend to have lower abnormal returns for insiders in their stock sales.

Interestingly, the impact of stock risk on insider abnormal returns in the Sell/Bad news sample differs from the findings in the Buy/Good news sample in Table 5. We observe a negative coefficient for stock return volatility $RETVOL$ and a positive coefficient for change in stock return volatility Δ_RETVOL . This suggests that insiders in firms characterized by low but increasing equity risk are more inclined to exploit earnings information to benefit their stock sales.

Overall, the findings in Tables 5 and 6 suggest that both insider purchasing and selling activities can provide meaningful insights into firms' future earnings information. The relationship between earnings surprises and insider returns is more significant for insider purchases. Table 5 shows a positive and strongly significant association between insider buying activities and both proxies of corporate earnings. This indicates that insiders tend to achieve higher returns when they purchase stocks in response to positive news about future earnings. On the other hand, Table 6 reveals a negative and weaker significant relationship between insider returns and earnings surprises, specifically in the $SURPRISE$ model.

Notably, there are differences in the relationship between the CEO pay gap and the profitability of insider trading between the Buy/Good news and Sell/Bad news transactions. A larger CEO pay gap is associated with higher abnormal returns for insiders purchasing new shares, while it is associated with lower abnormal returns for insiders selling their shares. When the interaction term between $SURPRISE$ and $CEOGAP_{-1}$ is incorporated, it adds further impact to insider abnormal returns.

Furthermore, the contrasting impact of earnings accruals on insider trading in purchase and sale activities shows that insiders manipulate earnings to align with their objectives, suggesting the use of earnings management strategies to enhance their trading outcomes.

Regarding trading volumes, our contrasting results indicate that insiders increase purchase volumes when exploiting positive news about firms' future earnings, while decreasing selling volumes when capitalizing on negative news. This suggests that insiders strategically adjust their trading volumes based on their anticipation of earnings outcomes.

This study also finds that operating cash flows are negatively and significantly related to insider purchase returns, while the relationship between operating cash flows and insider sale returns is positive but weaker.

Lastly, higher stock return volatility is associated with higher insider purchase returns, but a negative relationship exists between insider purchase returns and changes in stock return volatility. This can be interpreted in two ways: A decrease in return volatility indicates a more stable market with limited opportunities for insiders. Or insiders are less successful in generating abnormal returns when market conditions become more predictable. Conversely, higher stock return volatility is linked to lower insider sale returns, and there is a positive relationship between insider sale returns and changes in stock-return volatility. This suggests that insiders in firms characterized by low but increasing equity risk are more likely to exploit earnings information to benefit their stock sales.

5. Robustness Tests

5.1. Additional Managerial Controls

To ensure the robustness of our findings, we conducted additional tests to examine managerial determinants that could impact corporate insider returns. These determinants provide insights into the overall quality of a firm's corporate governance. We included variables such as CEO tenure (*CEOTENURE*) to assess the impact of CEO incumbency on insider returns, CEO/Chairman duality (*CEODUAL*) to capture the influence of combining these roles, board size (*BOARDSIZE*) to control for the size and composition of the board of directors, and the percentage of independent directors on the board (*INDDIR*) to explore the relationship between independent directors and insider trading outcomes.

In Table 7, which presents the results for the Buy/Good news sample, we find that the positive and strongly significant relationships between insider returns and key explanatory variables, such as *SURPRISE*, *CEOGAP₋₁*, the interaction term between *CEOGAP₋₁* and *SURPRISE*, and *LnBUY*, persisted after introducing the managerial variables. Earnings surprises have a significantly strong impact on insider purchase returns in columns (3), (4), (5), and (6), with corresponding coefficients being 0.03, 0.06, 0.07, and 0.06, respectively. CEO pay gaps are significant in columns (2), (3), (4), (5), and (6), with the corresponding coefficients being 4.14, 7.80, 9.91, 10.72, and 14.90, respectively. The interaction between earnings surprises and the CEO pay gap exhibits strong significance in columns (2), (3), (4), (5), and (6), with corresponding coefficients of 0.15, 0.26, 0.41, 0.44, and 0.44, respectively.

These findings, like those in Table 5, support our hypothesis *H1* regarding insider trading behavior and its association with the CEO pay gap, earnings surprise, and purchasing volume. The inclusion of these managerial variables did not significantly impact the relationships between insider trading and our key variables. Similar to the discussion of results in Table 5, the positive impacts of the CEO pay gap on insider abnormal returns can be explained by several factors. First, a large CEO pay gap indicates power concentration and lower board quality. Insiders, with superior information, exploit this advantage through insider purchases, benefiting from positive earnings news and achieving higher returns. Second, firms with a larger CEO pay gap often face higher CEO entrenchment and succession risk, indicating uncertain business environments. Insiders strategically time their purchases to align with positive earnings news, resulting in higher insider purchase returns. Third, a larger CEO pay gap can signal a skilled and experienced CEO leading the company's success. This boosts investor confidence and attracts more investors, increasing demand for the company's stock and driving up insider purchase returns. Fourth, a large CEO pay gap reflects a concentration of power and control within the CEO's hands. CEOs can act opportunistically and exploit good earnings news for personal gain through insider purchases, contributing to higher insider purchase returns.

Table 7. Additional regression model—Buy before Good news disclosures.

Dependent Variable:	SURPRISE						ChgEARNINGS					
	CAR [5] (1)	CAR [0-10] (2)	CAR [0-20] (3)	CAR [0-30] (4)	CAR [0-40] (5)	CAR [0-50] (6)	CAR [0-5] (7)	CAR [0-10] (8)	CAR [0-20] (9)	CAR [0-30] (10)	CAR [0-40] (11)	CAR [0-50] (12)
SURPRISE	0.004 (0.243)	0.005 (0.144)	0.033 *** (0.000)	0.065 *** (0.000)	0.069 *** (0.000)	0.064 *** (0.000)	-0.001 (0.645)	-0.005 * (0.053)	0.003 (0.379)	0.009 * (0.054)	0.009 * (0.095)	0.007 (0.209)
ChgEARNINGS												
CEOGAP ₋₁	2.672 (0.212)	4.136 * (0.095)	7.800 ** (0.012)	9.913 ** (0.013)	10.721 ** (0.016)	14.897 *** (0.002)	2.401 (0.237)	3.209 (0.173)	5.359 * (0.082)	5.545 (0.176)	5.757 (0.206)	10.792 ** (0.021)
CEOGAP ₋₁ *SURPRISE	0.029 (0.437)	0.150 *** (0.000)	0.266 *** (0.000)	0.407 *** (0.000)	0.444 *** (0.000)	0.444 *** (0.000)						
CEOGAP ₋₁ *ChgEARNINGS												
ACCRUALS	3.794 (0.271)	7.452 * (0.062)	11.716 ** (0.020)	7.038 (0.269)	0.991 (0.890)	8.58 (0.248)	0.044 (0.109)	0.034 (0.275)	0.032 (0.436)	0.013 (0.816)	-0.024 (0.690)	-0.044 (0.474)
LnBUY	0.015 (0.833)	0.058 (0.466)	0.307 *** (0.003)	0.363 *** (0.005)	0.456 *** (0.002)	0.403 *** (0.007)	0.027 (0.685)	0.068 (0.384)	0.296 *** (0.004)	0.351 *** (0.010)	0.427 *** (0.005)	0.379 ** (0.014)
OCFPS ₋₁	-0.05 (0.475)	-0.054 (0.505)	-0.328 *** (0.002)	-0.333 ** (0.011)	-0.297 ** (0.043)	-0.185 (0.224)	-0.059 (0.324)	-0.07 (0.310)	-0.309 *** (0.001)	-0.386 *** (0.002)	-0.353 *** (0.009)	-0.291 ** (0.034)
FIRMSIZE	-0.029 (0.915)	-0.141 (0.655)	0.031 (0.937)	-0.408 (0.419)	-0.257 (0.650)	-0.309 (0.599)	0.019 (0.944)	-0.086 (0.776)	0.172 (0.665)	-0.148 (0.780)	0.144 (0.806)	0.144 (0.810)
LnMB	-0.071 (0.826)	-0.116 (0.754)	0.404 (0.385)	0.974 (0.101)	1.179 * (0.077)	1.686 ** (0.015)	-0.057 (0.849)	-0.052 (0.883)	0.274 (0.547)	0.663 (0.274)	0.772 (0.252)	1.317 * (0.056)
LEVERAGE ₋₁	0.045 *** (0.005)	0.050 *** (0.006)	0.067 *** (0.004)	0.078 *** (0.008)	0.085 *** (0.010)	0.087 ** (0.011)	0.044 *** (0.005)	0.045 ** (0.012)	0.063 *** (0.008)	0.076 ** (0.015)	0.081 ** (0.019)	0.083 ** (0.019)
RETVOL	0.256 (0.413)	0.355 (0.326)	0.966 ** (0.034)	1.582 *** (0.007)	3.093 *** (0.000)	3.993 *** (0.000)	0.481 * (0.093)	0.591 * (0.075)	2.121 *** (0.000)	4.059 *** (0.000)	5.720 *** (0.000)	6.584 *** (0.000)
Δ RETVOL	-1.332** (0.000)	-1.947*** (0.000)	-4.236*** (0.000)	-5.175*** (0.000)	-5.584*** (0.000)	-6.791*** (0.000)	-1.821*** (0.000)	-2.407*** (0.000)	-5.956*** (0.000)	-8.660*** (0.000)	-9.356*** (0.000)	-10.402*** (0.000)
CEOTENURE	-0.002 (0.975)	0.047 (0.429)	0.087 (0.245)	0.107 (0.264)	0.088 (0.414)	0.088 (0.432)	0.022 (0.658)	0.115 ** (0.046)	0.249 *** (0.001)	0.396 *** (0.000)	0.393 *** (0.000)	0.383 *** (0.001)
CEODUAL	0.889 (0.257)	1.934 ** (0.033)	4.196 *** (0.000)	3.172 ** (0.029)	3.345 ** (0.040)	2.869 * (0.090)	1.161 (0.127)	2.498 *** (0.005)	5.682 *** (0.000)	6.000 *** (0.000)	6.272 *** (0.000)	5.738 *** (0.001)
INDDIR	-0.002 (0.916)	-0.004 (0.845)	-0.014 (0.583)	-0.061 * (0.059)	-0.079 ** (0.030)	-0.059 (0.117)	0.003 (0.839)	0.008 (0.677)	0.008 (0.768)	-0.035 (0.305)	-0.053 (0.165)	-0.041 (0.294)
BOARDSIZE	0.083 (0.332)	0.062 (0.532)	0.172 (0.166)	0.087 (0.582)	0.005 (0.980)	0.011 (0.953)	0.069 (0.403)	0.045 (0.639)	0.031 (0.806)	-0.17 (0.310)	-0.301 (0.106)	-0.278 (0.143)

Table 7. Cont.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0–10] (2)	CAR [0–20] (3)	CAR [0–30] (4)	CAR [0–40] (5)	CAR [0–50] (6)	CAR [0–5] (7)	CAR [0–10] (8)	CAR [0–20] (9)	CAR [0–30] (10)	CAR [0–40] (11)	CAR [0–50] (12)
Constant	−2.721 (0.336)	−2.676 (0.413)	−9.789 ** (0.017)	−3.728 (0.475)	−6.638 (0.257)	−10.411 * (0.088)	−3.954 (0.149)	−4.47 (0.160)	−13.152 ** (0.002)	−9.642 * (0.081)	−13.338 ** (0.030)	−17.281 ** (0.006)
Observations	755	755	755	755	755	755	767	767	767	767	767	767
Adjusted R ²	0.054	0.111	0.395	0.474	0.466	0.467	0.071	0.12	0.339	0.383	0.386	0.411

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR* [event period]. *SURPRISE* is earning surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year t and year $t - 1$ divided by earnings per share year $t - 1$. *CEOGAP* _{$t-1$} is the CEO gap ratio of year $t - 1$, measured as the difference between the total CEO pay and the mean of other four executives' pay divided by the total pay of the top five executives; *CEOGAP* _{$t-1$} **SURPRISE* is the interactive variable between *CEOGAP* _{$t-1$} and *SURPRISE*; *CEOGAP* _{$t-1$} **ChgEARNINGS* is the interactive variable between *CEOGAP* _{$t-1$} and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using a modified version of the Jones (1991) model. Insiders' trading volume *LnBUY* is the natural logarithm of the buying volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market-to-book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE* _{$t-1$} is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ *RETVOL* equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. CEO's tenure *CEOTENURE* is the number of years that a CEO has been at the helm of a firm. A dummy variable *CEODUAL* equals to one if CEO holds the position of the chairman of the board; otherwise, it equals zero. Percentage of independent directors *INDDIR* is the number of independent directors divided by the total number of members of the board. *BOARDSIZE* is the total number of members of the board. The p -values are shown below the estimates in parentheses (*: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.01$).

The results for the managerial variables in Table 7 show that board size does not have a statistically significant impact on insider returns, while CEO/chairman duality, CEO tenure, and the presence of independent directors do show significant relationships. The positive relationship between *CEOTENURE* and *CARs* suggests that CEOs with longer tenures have a deeper understanding of the company and its future prospects. Their experience and knowledge allow them to make more informed decisions when purchasing company stock, leading to higher returns for insiders involved in these transactions. *CEODUAL* has a positive and significant effect on *CARs* in most columns, except for columns (1) and (7), indicating that firms with combined CEO and chairman roles experienced higher insider returns. This aligns with Ryan and Wiggins (2001), suggesting that dominant CEOs may prioritize personal agendas, motivating non-CEO executives to seek alternative income sources, including insider trading. The coefficients of *INDDIR* are significantly negative for the event periods [0–30] and [0–40], indicating that an increase of one independent director within a firm resulted in a decrease of 0.06% and 0.08% in insider buying returns in columns (3) and (4), respectively. This aligns with the findings of Hermalin and Weisbach (2003), suggesting that the presence of independent directors can impact the behavior and decisions of corporate insiders.

The control variables in Table 7 are consistent with our findings in Table 5. We find a positive and significant association between *ACCRUALS* and *CARs* in multiple columns (2), (3), (8), (9), (10), and (12). This supports previous studies by Aboody et al. (2005), Sawicki and Shrestha (2012), and Chowdhury et al. (2017), which suggest that insiders engage in earnings management to benefit from their stock trading activities. *LnBUY* exhibits a positive and significant relationship with *CARs* in columns (3) to (6) and (9) to (12). This implies that larger volume stock purchases by insiders influence outsiders to imitate their trades, leading to increased stock market prices and improved insider abnormal returns. These findings align with Bettis et al. (1997), who suggest that outsiders can achieve significant abnormal returns by replicating insider trades. We also find a negative and significant relationship between *OCFPS₋₁* and *CARs* in columns (3) to (5) and (9) to (12). Insiders in firms with declining cash flows tend to achieve higher returns from their insider purchases. This negative relationship can be explained by factors outlined in the discussion of Table 5, including information advantage, undervaluation, and contrarian investing. Insiders leverage their non-public information to strategically time their purchases, anticipating recoveries or positive developments not yet reflected in the stock price. They may also take advantage of lower stock prices resulting from declining cash flows, expecting future improvements in the company's performance. Additionally, insiders with a contrarian investment approach buy shares when others are pessimistic, anticipating a future recovery and subsequent increase in stock prices. Moreover, we find a positive association between *CARs* and *LEVERAGE₋₁* in all columns, indicating that companies with higher debt levels tend to generate greater insider abnormal returns. The coefficient for stock return volatility *RETVOL* exhibits a strongly positive association with cumulative abnormal returns *CARs*, from columns (3) to (12). This means that as return volatility increases, the cumulative abnormal returns generated by insider trading also increase. We also observe a negative relationship between *CARs* and Δ_RETVOL in all columns. A decrease in return volatility indicates a more stable and less volatile market environment, limiting the opportunities for insiders to exploit mispriced securities or market inefficiencies. Hence, the cumulative abnormal returns derived from insider trading activities may decrease. This finding is consistent with the studies of Aggarwal and Samwick (1999, 2003) and Jin (2002).

Table 8 presents results for the Sell/Bad news sample with managerial variables. The coefficients remain significant and are similar to those in Table 6, indicating no change in relationships. We observe negative and significant coefficients for insider cumulative abnormal returns (*CARs*) in relation to *SURPRISE* only in columns (2) and (4). As discussed in Table 6, several factors can explain the differences in signs and the weaker relationship compared to insider purchases in the Buy/Good news sample. Firstly, information

asymmetry may play a role. Insider sales before bad earnings news suggest that insiders possess negative information about the company's financial performance. However, this negative information may not be equally known or accessible to the general public or other market participants. As a result, the market may not fully incorporate the negative news until the official earnings announcement, leading to a weaker relationship between insider sale returns and subsequent earnings surprises. Secondly, insiders' motivation may differ between insider purchases and sales. Insider purchases before good earnings news often signal confidence in the company's prospects. Conversely, insider sales before bad earnings news can stem from various motivations, such as personal financial needs, diversification, or even pessimistic views about the company's future. These diverse motivations can dilute the relationship between insider sales and earnings surprises. Thirdly, market response also plays a role. Positive earnings surprises often trigger an immediate increase in stock price, reflecting the market's positive response. In contrast, negative earnings surprises may receive a more subdued or delayed market reaction. This difference in market response contributes to the weaker relationship between insider sales and earnings surprises when compared to insider purchases. Lastly, timing and reporting discrepancies may affect the relationship. Insiders may have more timely access to positive information, enabling them to make purchases before the news becomes public. In contrast, negative news or poor earnings may take longer to materialize or be fully realized by insiders, leading to delays in insider sales. This timing discrepancy can impact the strength of the relationship between insider transactions and subsequent earnings surprises.

The coefficients for *CEOGAP*₋₁ show a negative and statistically significant relationship in columns (5) and (6). Notably, when we analyze the interaction between *CEOGAP*₋₁ and earnings variables (*SURPRISE* and *ChgEARNINGS*) we observe that the coefficients associated with this interaction term are negative and statistically significant in columns (1), (2), (3), (4), (11), and (12). These results, consistent with our hypothesis H2, indicate that the negative and significant relationship between CEO pay gap and *CARs* magnified because of the influence of earnings surprise/change. These findings provide valuable insights into the intricate dynamics among CEO pay gap, management quality, and insider returns in the context of insider selling activities. They suggest that the CEO pay gap plays a crucial role in shaping the incentives and motivations of insiders, ultimately influencing their trading behavior and the resulting abnormal returns. Firms with a larger CEO gap ratio tend to motivate executives to strive harder to attain the CEO position, thereby enhancing the overall management quality of the firm and leading to lower insider returns (as supported by Lambert et al. 1993; Main et al. 1995; Bebchuk and Fried 2003; Kale et al. 2009, among others). Vice versa, a smaller gap between the CEO and other executives may discourage them from aspiring to the CEO position, potentially diminishing the firm's management quality. In such cases, insiders may be incentivized to exploit their informational advantages in stock sales, resulting in higher insider returns (as suggested by Inci 2012; Dai et al. 2016).

In Table 8, we observe weakly significant relationships between insider returns and managerial control variables, i.e., CEO's tenure, CEO/Chairman duality, and independent directors. These results have limited use, given that there is no strong significant association between insider returns prior to earnings announcements and the main earnings proxy variables (*SURPRISE* and *ChgEARNINGS*).

Table 8. Additional regression model—Sell before the Bad news disclosures.

Dependent Variable:	SURPRISE						ChgEARNINGS					
	CAR [5] (1)	CAR [0–10] (2)	CAR [0–20] (3)	CAR [0–30] (4)	CAR [0–40] (5)	CAR [0–50] (6)	CAR [0–5] (7)	CAR [0–10] (8)	CAR [0–20] (9)	CAR [0–30] (10)	CAR [0–40] (11)	CAR [0–50] (12)
SURPRISE	−0.003 (0.259)	−0.007 ** (0.021)	0.001 (0.750)	−0.012 ** (0.030)	−0.008 (0.181)	−0.006 (0.402)						
ChgEARNINGS												
CEOGAP _{−1}	−0.341 (0.692)	−1.146 (0.328)	−2.049 (0.199)	−3.221 (0.102)	−3.857 * (0.084)	−4.780 * (0.066)	0.001 (0.619)	0.002 (0.328)	0.004 (0.214)	0.004 (0.202)	0.002 (0.539)	0.004 (0.433)
CEOGAP _{−1} *SURPRISE	−0.111** (0.000)	−0.120*** (0.007)	−0.169*** (0.006)	−0.216*** (0.004)	−0.083 (0.323)	−0.106 (0.280)						−2.257 (0.385)
CEOGAP _{−1} *ChgEARNINGS							0.021 * (0.078)	0.004 (0.830)	−0.012 (0.639)	−0.024 (0.430)	−0.075 ** (0.025)	−0.115*** (0.004)
ACCRUALS	−7.359** (0.000)	−8.582*** (0.001)	−8.167 ** (0.019)	−15.209** (0.000)	−17.972*** (0.000)	−14.399 ** (0.012)	−7.336*** (0.000)	−9.477*** (0.000)	−8.717 ** (0.017)	−15.068** (0.001)	−16.776** (0.001)	−13.274** (0.020)
LnSELL	0.036 (0.462)	−0.018 (0.794)	−0.11 (0.231)	−0.269 ** (0.018)	−0.263 ** (0.041)	−0.341 ** (0.023)	−0.016 (0.738)	−0.099 (0.135)	−0.294*** (0.003)	−0.442*** (0.000)	−0.400*** (0.002)	−0.499*** (0.001)
OCFPS _{−1}	0.015 (0.597)	0.021 (0.604)	0.062 (0.252)	0.1 (0.132)	0.134 * (0.076)	0.149 * (0.090)	0.022 (0.368)	0.02 (0.577)	0.099 * (0.053)	0.101 (0.107)	0.141 ** (0.040)	0.138 * (0.085)
FIRMSIZE	−0.216* (0.064)	−0.491*** (0.002)	−0.491 ** (0.024)	−0.589 ** (0.028)	−0.757 ** (0.013)	−0.737 ** (0.037)	−0.260 ** (0.018)	−0.619*** (0.000)	−0.637*** (0.005)	−0.657 ** (0.017)	−0.809*** (0.007)	−0.787 ** (0.025)
LnMB	−0.26 (0.179)	−0.319 (0.224)	−0.665 * (0.063)	−0.42 (0.342)	−0.202 (0.686)	−0.693 (0.235)	−0.172 (0.333)	−0.169 (0.506)	−0.491 (0.179)	−0.183 (0.683)	−0.091 (0.852)	−0.625 (0.274)
LEVERAGE _{−1}	0.002 (0.800)	−0.009 (0.448)	−0.004 (0.789)	−0.004 (0.830)	−0.006 (0.805)	0.01 (0.703)	−0.004 (0.632)	−0.024 ** (0.041)	−0.019 (0.280)	−0.016 (0.451)	−0.016 (0.496)	−0.003 (0.921)
RETVOL	−0.739** (0.000)	−1.003*** (0.000)	−1.549*** (0.000)	−1.633*** (0.000)	−1.512 *** (0.000)	−1.950 *** (0.000)	−0.822*** (0.000)	−1.517*** (0.000)	−2.443*** (0.000)	−2.594*** (0.000)	−2.154*** (0.000)	−2.868*** (0.000)
Δ RETVOL	1.197 *** (0.000)	1.578 *** (0.000)	2.776 *** (0.000)	3.122 *** (0.000)	3.010 *** (0.000)	3.608 *** (0.000)	1.444 *** (0.000)	2.683 *** (0.000)	4.619 *** (0.000)	5.179 *** (0.000)	4.653 *** (0.000)	5.883 *** (0.000)
CEOTENURE	−0.040* (0.068)	−0.036 (0.231)	−0.076 * (0.060)	−0.03 (0.545)	0.043 (0.451)	0.06 (0.361)	−0.036 * (0.081)	−0.029 (0.316)	−0.093 ** (0.027)	−0.037 (0.469)	0.048 (0.389)	0.055 (0.399)
CEODUAL	−0.185 (0.542)	0.075 (0.857)	−0.523 (0.351)	−0.774 (0.263)	−1.177 (0.133)	−0.917 (0.316)	−0.295 (0.293)	−0.499 (0.213)	−1.453 ** (0.012)	−1.709 ** (0.016)	−1.956 ** (0.012)	−1.684 * (0.062)
INDDIR	−0.002 (0.872)	0.012 (0.364)	0.0001 (0.996)	0.016 (0.469)	0.038 (0.119)	0.024 (0.404)	0.002 (0.816)	0.028 ** (0.022)	0.022 (0.210)	0.034 (0.122)	0.057 ** (0.017)	0.043 (0.122)
BOARDSIZE	0.065 (0.179)	0.092 (0.162)	0.14 (0.116)	0.154 (0.1620)	0.162 (0.193)	0.157 (0.280)	0.032 (0.463)	0.103 (0.103)	0.074 (0.418)	0.057 (0.611)	0.12 (0.321)	0.11 (0.436)

Table 8. Cont.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0–10] (2)	CAR [0–20] (3)	CAR [0–30] (4)	CAR [0–40] (5)	CAR [0–50] (6)	CAR [0–5] (7)	CAR [0–10] (8)	CAR [0–20] (9)	CAR [0–30] (10)	CAR [0–40] (11)	CAR [0–50] (12)
Constant	2.941 ** (0.047)	5.824 *** (0.004)	9.034 *** (0.001)	10.233 *** (0.003)	9.674 ** (0.012)	12.560 *** (0.005)	4.178 *** (0.003)	7.513 *** (0.000)	12.616 *** (0.000)	13.323 *** (0.000)	11.007 *** (0.005)	14.539 *** (0.002)
Observations	1201	1201	1201	1201	1201	1201	1257	1257	1257	1257	1257	1257
Adjusted R ²	0.067	0.059	0.082	0.084	0.057	0.05	0.071	0.108	0.146	0.126	0.094	0.094

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR* [event period]. *SURPRISE* is earning surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year t and year $t - 1$ divided by earnings per share year $t - 1$. *CEOGAP* _{$t-1$} is the CEO gap ratio of year $t - 1$, measured as the difference between the total CEO pay and the mean of other four executives' pay divided by the total pay of the top five executives; *CEOGAP* _{$t-1$} **SURPRISE* is the interactive variable between *CEOGAP* _{$t-1$} and *SURPRISE*; *CEOGAP* _{$t-1$} **ChgEARNINGS* is the interactive variable between *CEOGAP* _{$t-1$} and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using a modified version of the Jones (1991) model. Insiders' trading volume *LnSELL* is the natural logarithm of the buying volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market-to-book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE* _{$t-1$} is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ *RETVOL* equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. CEO's tenure *CEOTENURE* is the number of years that a CEO has been at the helm of a firm. A dummy variable *CEODUAL* equals to one if the CEO holds the position of the chairman of the board; otherwise, it equals zero. Percentage of independent directors *INDDIR* is the number of independent directors divided by the total number of members of the board. *BOARDSIZE* is the total number of members of the board. The p -values are shown below the estimates in parentheses (). * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The relationships between insider abnormal returns and the control variables in Table 8 are consistent with Table 6. First, we observe the strongly significant negative coefficients for earnings management *ACCRUALS*, indicating that insider abnormal returns from stock sales are strongly influenced by managers' earnings-management practices. Second, we find negative and significant coefficients of *LnSELL* in columns (4), (5), (6), and (9) to (12). When there is a lower level of insider trading activity (i.e., fewer shares being sold by insiders), the insiders who do engage in selling tend to achieve higher returns from those sales. The explanation could be that when insider trading volume is low, the insiders who decide to sell their shares are likely doing so based on more significant and valuable information. They may have insider knowledge about negative developments or poor future prospects of the company, leading them to strategically time their sales to maximize their returns. As a result, the limited insider selling that occurs during this period tends to generate higher-than-average returns. In contrast, when insider trading volume is high, it implies that there is a greater number of insiders selling their shares. This broader participation may dilute the impact of any particular insider's selling activity, leading to more average or lower returns. The coefficients of *FIRMSIZE* exhibit a consistent negative and significant association with *CARs* across all columns (1) to (12), which aligns with prior research (Seyhun 1986; Agrawal and Cooper 2015). This implies that larger firms tend to have lower abnormal returns for insiders in their stock sales. Notably, the impact of a stock risk on insider abnormal returns in the Sell/Bad news sample in Table 8 contrasts with the findings in the Buy/Good news sample presented in Table 7. Specifically, there is a negative coefficient for stock return volatility *RETVOL* and a positive coefficient for change in stock return volatility Δ_RETVOL in all columns. This suggests that insiders in firms characterized by low but increasing equity risk are more inclined to exploit earnings information to benefit from their stock sales.

Overall, the findings presented in Tables 7 and 8 are consistent with the results obtained in Tables 5 and 6, respectively. Insider returns from both purchasing and selling activities serve as meaningful indicators of firms' future earnings information with the relationship between earnings surprises and insider returns being more significant for the purchase sample. Particularly, in Table 7, a positive and significant association is revealed between the profitability of insiders' buying activities and both proxies of corporate earnings. This suggests that insiders tend to achieve higher returns when purchasing stocks in response to positive news about future earnings. In contrast, Table 8 documents a weaker negative and significant relationship between insider returns and earnings surprises.

Importantly, notable differences emerge in the relationship between the CEO pay gap and the profitability of insider trading between the Buy/Good news and Sell/Bad news transactions. The impact of the CEO pay gap on insider returns remains statistically significant when considering earnings surprise, with a stronger positive effect observed in the buy sample compared to a weaker negative effect observed in the sell sample. Moreover, when incorporating the interaction term between *SURPRISE* and *CEOGAP₋₁*, the effect of CEO pay gap on insider abnormal returns becomes more pronounced in both the Buy/Good news and Sell/Bad news samples.

Furthermore, when examining the impact of earnings accruals on insider trading, it is observed that insiders may manipulate earnings to align with their objectives. This suggests that more sophisticated insiders exploit earnings management strategies to enhance their trading outcomes.

Lastly, the contrasting results regarding the association between insider returns and trading volumes of insider purchases and sales indicate that insiders increase their purchase volumes when exploiting good news about firms' future earnings, while decreasing their selling volumes when capitalizing on bad news. This suggests that insiders strategically adjust their trading volumes based on their anticipation of the direction of earnings outcomes.

5.2. Alternative Measure of Executive Pay Disparity

It is possible that the CEO pay gap does not fully capture all available information regarding executive pay disparity. To address this concern, we use the alternative measure for executive pay disparity, CEO pay slice (CPS), as proposed by Bebchuk et al. (2011) to assess whether the results obtained from the primary models are consistent. In this section, we replicate our models in Equations (4) and (5) using the CEO pay slice in the previous year CPS_{-1} . The CEO pay slice CPS is defined as the ratio of the total pay of the CEO to the total compensation awarded to the top five executives. We present the results of these models in Tables 9 and 10.

The coefficients associated with CEO pay slice CPS in the regressions in Tables 9 and 10 have similar magnitudes as those reported for the CEO pay gap in Tables 5 and 6, respectively. This suggests that the inference drawn from the main models remains robust when considering alternative measures of executive pay disparity.

Table 9 in the Buy/Good news sample reveals several noteworthy findings. Firstly, in columns (1) to (6), the coefficients associated with *SURPRISE* in all event windows are positive and statistically significant. This indicates a strong positive relationship between earnings surprise and insider returns. Furthermore, in columns (10) and (11), the coefficients of *ChgEARNINGS* also exhibit positive and significant values.

Importantly, the analysis provides further compelling evidence of the impact of CEO pay slice on insider returns, particularly in the earnings surprise columns (2) to (6). The inclusion of the interaction term further strengthens the effect of CPS_{-1} when it interacts with earnings surprise. These results serve to reaffirm the validity of our hypothesis H1.

The effects of control variables, including *ACCRUALS*, *LnBUY*, *OCFPS₋₁*, *LEVERAGE₋₁*, *RETVOL*, and Δ_RETVOL , on insider purchase returns in CEO pay slice models exhibit comparable quantitative patterns to our primary model. The relationships between these variables and insider returns remain consistent across both measures of executive pay disparity.

Table 10 displays the outcomes of the regression analysis conducted on the Sell/Bad news sample. We find negative associations between earnings surprise and insider sale returns for 10-day, 30-day, and 40-day event windows in columns (2), (4), and (5). Utilizing *ChgEARNINGS* as the predictor, we observe negative and statistically significant relationships between CEO pay slice CPS_{-1} and insider returns for 10-day, 20-day, and 30-day event windows in columns (8), (9), and (10). This finding provides further confirmation of our tournament hypothesis H2 within the context of insider selling activities.

The effects of control variables, such as *ACCRUALS*, *LnSELL*, *OCFPS₋₁*, *LEVERAGE₋₁*, *RETVOL*, and Δ_RETVOL , on insider sale returns in our CEO pay slice models exhibit comparable quantitative patterns to our main model. The relationships between these variables and insider returns remain consistent using CEO pay slice as an alternative measure of executive pay disparity.

Overall, the results presented in both Tables 9 and 10 demonstrate the robustness of our findings. Regardless of whether we use CEO pay gap or CEO pay slice as the metric, the observed associations between executive pay disparity and insider returns remain consistent and significant.

Table 9. Alternative measure of disparity—Buy before the good news disclosures.

Dependent Variable	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0-10] (2)	CAR [0-20] (3)	CAR [0-30] (4)	CAR [0-40] (5)	CAR [0-50] (6)	CAR [0-5] (7)	CAR [0-10] (8)	CAR [0-20] (9)	CAR [0-30] (10)	CAR [0-40] (11)	CAR [0-50] (12)
SURPRISE	0.005 * (0.079)	0.013 *** (0.000)	0.047 *** (0.000)	0.085 *** (0.000)	0.091 *** (0.000)	0.090 *** (0.000)						
ChgEARNINGS							-0.001 (0.795)	-0.005 (0.086)	0.006 (0.126)	0.012 ** (0.020)	0.012 ** (0.034)	0.009 (0.117)
CPS_1	0.719 (0.544)	2.670 * (0.052)	6.256 *** (0.000)	6.587 *** (0.004)	7.148 *** (0.005)	8.575 *** (0.002)	0.209 (0.848)	1.143 (0.369)	2.701 (0.122)	1.798 (0.445)	1.209 (0.641)	3.213 (0.228)
CPS_1*SURPRISE	0.032 (0.157)	0.113 *** (0.000)	0.196 *** (0.000)	0.272 *** (0.000)	0.324 *** (0.000)	0.331 *** (0.000)						
CPS_1*ChgEARNINGS							0.017 (0.360)	0.001 (0.973)	0.015 (0.633)	-0.012 (0.763)	-0.024 (0.591)	-0.032 (0.497)
ACCRUALS	1.252 (0.688)	4.969 (0.169)	9.827 ** (0.035)	13.306 ** (0.026)	7.405 (0.265)	14.041 ** (0.044)	3.028 (0.349)	6.985 * (0.065)	18.581 *** (0.000)	26.020 *** (0.000)	18.394 ** (0.017)	25.743 *** (0.002)
LnBUY	0.01 (0.876)	0.046 (0.526)	0.261 *** (0.006)	0.362 *** (0.003)	0.448 *** (0.001)	0.466 *** (0.001)	0.022 (0.720)	0.065 (0.366)	0.323 *** (0.002)	0.441 *** (0.001)	0.510 *** (0.000)	0.523 *** (0.001)
OCFPS_1	-0.025 (0.698)	-0.06 (0.424)	-0.346 *** (0.000)	-0.426 *** (0.001)	-0.394 *** (0.005)	-0.337 ** (0.020)	-0.009 (0.862)	-0.061 (0.320)	-0.077 (0.360)	-0.259 ** (0.023)	-0.385 *** (0.003)	-0.368 *** (0.005)
FIRMSIZE	0.1 (0.651)	0.034 (0.896)	0.471 (0.154)	0.305 (0.471)	0.367 (0.436)	0.529 (0.285)	0.151 (0.482)	0.134 (0.592)	0.461 (0.180)	0.452 (0.329)	0.698 (0.171)	0.883 * (0.092)
LnMB	-0.113 (0.692)	-0.112 (0.736)	0.336 (0.430)	0.883 (0.106)	1.159 * (0.057)	1.484 ** (0.021)	-0.093 (0.731)	-0.039 (0.903)	0.237 (0.586)	0.725 (0.217)	0.961 (0.137)	1.357 ** (0.042)
LEVERAGE_1	0.042 *** (0.004)	0.052 *** (0.002)	0.067 *** (0.002)	0.044 (0.107)	0.049 (0.107)	0.044 (0.163)	0.042 *** (0.003)	0.047 *** (0.005)	0.061 *** (0.007)	0.036 (0.228)	0.042 (0.205)	0.035 (0.297)
RETVOL	0.33 (0.237)	0.447 (0.166)	1.269 *** (0.003)	1.684 *** (0.002)	3.122 *** (0.000)	3.821 *** (0.000)	0.655 ** (0.011)	0.932 *** (0.002)	2.618 *** (0.000)	4.673 *** (0.000)	6.288 *** (0.000)	7.117 *** (0.000)
Δ_RETVOL	-1.299*** (0.000)	-1.754 *** (0.000)	-4.055 *** (0.000)	-4.677 *** (0.000)	-5.174 *** (0.000)	-5.972 *** (0.000)	-1.740 *** (0.000)	-2.406 *** (0.000)	-6.068 *** (0.000)	-8.647 *** (0.000)	-9.458 *** (0.000)	-10.304*** (0.000)
Constant	-2.878 (0.251)	-3.863 (0.18)	-13.300*** (0.000)	-13.339*** (0.006)	-17.725 *** (0.001)	-21.678 *** (0.000)	-3.8 (0.113)	-4.977 * (0.076)	-14.392*** (0.000)	-17.970*** (0.001)	-23.548*** (0.000)	-28.099*** (0.000)
Observations	845	845	845	845	845	845	857	857	857	857	857	857
Adjusted R ²	0.05	0.097	0.358	0.444	0.44	0.438	0.061	0.091	0.255	0.292	0.308	0.332

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earnings proxies (*SURPRISE* and *ChgEARNINGS*). The dependent variable is cumulative abnormal return *CAR [event period]*; *SURPRISE* is earnings surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year t and year $t - 1$ divided by earnings per share year $t - 1$. *CPS₋₁* is the CEO pay slice of year $t - 1$, measured as the total CEO pay to the total pay of the top five executives; *CPS₋₁*SURPRISE* is the interactive variable between *CPS₋₁* and *SURPRISE*; *CPS₋₁*ChgEARNINGS* is the interactive variable between *CPS₋₁* and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using the modified version of the Jones (1991) model. *Insiders'* trading volume *LnBUY* is the natural logarithm of the buying volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market to book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE₋₁* is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [–250, –126] relative to the insider trading day. The change in standard deviation Δ_RETVOL equals the standard deviation of the firm's daily stock returns computed over trading days [–125, –1] relative to the insider trading day minus *RETVOL*. The p -values are shown below the estimates in parentheses (). * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 10. Alternative measure of disparity—Sell before the bad news disclosures.

Dependent Variable	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0–10] (2)	CAR [0–20] (3)	CAR [0–30] (4)	CAR [0–40] (5)	CAR [0–50] (6)	CAR [0–5] (7)	CAR [0–10] (8)	CAR [0–20] (9)	CAR [0–30] (10)	CAR [0–40] (11)	CAR [0–50] (12)
SURPRISE	−0.001 (0.795)	−0.005 * (0.086)	−0.006 (0.126)	−0.012 ** (0.020)	−0.012 ** (0.034)	0.009 (0.117)						
ChgEARNINGS												
CPS _{−1}	0.209 (0.848)	1.143 (0.369)	2.701 (0.122)	1.798 (0.445)	1.209 (0.641)	3.213 (0.228)	0.001 (0.298)	0.002 (0.307)	0.004 (0.152)	0.004 (0.183)	0.003 (0.428)	0.001 (0.819)
CPS _{−1} *SURPRISE	0.017 (0.360)	0.001 (0.973)	0.015 (0.633)	−0.012 (0.763)	−0.024 (0.591)	−0.032 (0.497)	−0.169 (0.739)	−1.701 ** (0.017)	−2.689 *** (0.009)	−2.845 ** (0.024)	−1.259 (0.363)	−2.382 (0.141)
CPS _{−1} *ChgEARNINGS												
ACCRUALS	3.028 (0.349)	6.985 * (0.065)	18.581 *** (0.000)	26.020 *** (0.000)	18.394 ** (0.017)	25.743 *** (0.002)	−7.166 *** (0.000)	−9.291 *** (0.000)	−10.472 *** (0.004)	−15.493 *** (0.000)	−16.949 *** (0.000)	−12.816 ** (0.023)
LnSELL	0.022 (0.720)	0.065 (0.366)	0.323 *** (0.002)	0.441 *** (0.001)	0.510 *** (0.000)	0.523 *** (0.001)	−0.035 (0.426)	−0.143 ** (0.022)	−0.371 *** (0.000)	−0.508 *** (0.000)	−0.457 *** (0.000)	−0.540 *** (0.000)
OCFPS _{−1}	−0.009 (0.862)	−0.061 (0.320)	−0.077 (0.360)	−0.259 ** (0.023)	−0.385 *** (0.003)	−0.368 *** (0.005)	−0.004 (0.896)	−0.034 (0.453)	−0.133 ** (0.044)	−0.177 ** (0.029)	−0.191 ** (0.032)	−0.141 (0.173)
FIRMSIZE	0.151 (0.482)	0.134 (0.592)	0.461 (0.180)	0.452 (0.329)	0.698 (0.171)	0.883 * (0.092)	−0.215 ** (0.022)	−0.515 *** (0.000)	−0.482 ** (0.012)	−0.448 * (0.055)	−0.457 * (0.075)	−0.43 (0.151)
LnMB	−0.093 (0.731)	−0.039 (0.903)	0.237 (0.586)	0.725 (0.217)	0.961 (0.137)	1.357 ** (0.042)	−0.171 (0.277)	−0.127 (0.568)	−0.251 (0.434)	0.049 (0.901)	0.369 (0.393)	−0.225 (0.656)
LEVERAGE _{−1}	0.042 *** (0.003)	0.047 *** (0.005)	0.061 *** (0.007)	0.036 (0.228)	0.042 (0.205)	0.035 (0.297)	−0.008 (0.284)	−0.026 ** (0.020)	−0.035 ** (0.028)	−0.035 * (0.075)	−0.048 ** (0.027)	−0.033 (0.195)
RETVOL	0.655 ** (0.011)	0.932 *** (0.002)	2.618 *** (0.000)	4.673 *** (0.000)	6.288 *** (0.000)	7.117 *** (0.000)	−0.793 *** (0.000)	−1.486 *** (0.000)	−2.531 *** (0.000)	−2.622 *** (0.000)	−2.090 *** (0.000)	−2.696 *** (0.000)
Δ_RETVOL	−1.740*** (0.000)	−2.406 *** (0.000)	−6.068 *** (0.000)	−8.647 *** (0.000)	−9.458 *** (0.000)	−10.304 *** (0.000)	1.311 *** (0.000)	2.503 *** (0.000)	4.281 *** (0.000)	4.692 *** (0.000)	3.945 *** (0.000)	4.905 *** (0.000)
Constant	−3.8 (0.113)	−4.977 * (0.076)	−14.392*** (0.000)	−17.970*** (0.001)	−23.548 *** (0.000)	−28.099 *** (0.000)	4.248 *** (0.000)	10.689 *** (0.000)	15.259 *** (0.000)	16.403 *** (0.000)	14.826 *** (0.000)	17.284 *** (0.000)
Observations	857	857	857	857	857	857	1395	1395	1395	1395	1395	1395
Adjusted R ²	0.061	0.091	0.255	0.292	0.308	0.332	0.054	0.09	0.121	0.104	0.066	0.068

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earnings proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR [event period]*. *SURPRISE* is the change between surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year *t* and year *t* − 1 divided by earnings per share year *t* − 1. *CPS_{−1}* is the CEO pay slice *CPS* of year *t* − 1, measured as the total CEO pay to the total pay of the top five executives; *CPS_{−1}*SURPRISE* is the interactive variable between *CPS_{−1}* and *SURPRISE*; *CPS_{−1}*ChgEARNINGS* is the interactive variable between *CPS_{−1}* and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using the modified version of the Jones (1991) model. Insiders' trading volume *LnSELL* is the natural logarithm of the selling volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market to book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE_{−1}* is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ_RETVOL equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. The *p*-values are shown below the estimates in parentheses (* *p* < 0.1; ** *p* < 0.05; *** *p* < 0.01).

5.3. CEO Pay Slice with Additional Managerial Variables

To ensure the reliability of our findings, we conduct robustness checks using CEO pay slice CPS_{-1} along with additional managerial determinants of corporate insider returns such as the CEO's tenure, $CEOTENURE$, CEO duality, $CEODUAL$, the number of independent directors, $INDDIR$, and board size, $BOARDSIZE$. The results from the Buy/Good news sample, as presented in Table 11, align with our expectations. Consistent with literature, we find a positive and significant relationship between earnings surprise and insider trading in columns (2) to (5). Furthermore, the coefficients of CEO pay slice CPS_{-1} exhibit a positive relationship with insider returns for columns (3), (4), and (5), i.e., the 20-day, 30-day, and 40-day event windows, with statistical significance levels at 1%, 10%, and 10%, respectively. This indicates that the CEO pay slice has a significant impact on insider returns during these time intervals. Notably, the interaction term between CPS_{-1} and earnings surprises is strongly significant in columns (2) to (5), underscoring the amplified effect of the CEO pay slice on insider purchase returns. This confirms the crucial role of earnings surprise in the connection between the CEO pay slice and insider trading within the context of insider purchase activities.

Turning our attention to the managerial variables in Table 11, CEO duality shows a positive and significant association with insider trading returns in columns (2) to (5) and (8) to (12), indicating its strong influence on insider trading behavior. Furthermore, CEO tenure has a strong and positive impact on insider purchase returns in columns (8) to (12). This suggests that longer-tenured CEOs, with their accumulated knowledge and experience, make more informed decisions when purchasing company stock, resulting in higher insider returns.

The other control variables analyzed in Table 11 exhibit similar signs and levels of significance to those reported in Table 7. These consistent findings reinforce the directional and statistical relationships identified in Table 7.

The regression results of the Sell/Bad news sample, as presented in Table 12, exhibit similarities to the findings reported in Table 8 regarding the signs and significance levels. Specifically, the results reveal negative and significant associations between earnings surprise and insider returns across the 30-day, 40-day, and 50-day event windows. Of particular importance is the identification of an incremental joint effect of earnings surprise on the relationship between CEO pay slice CPS_{-1} and insider returns in columns (1) to (7). This finding provides compelling evidence in support of our tournament hypothesis H2 in the context of insider selling activities.

The managerial and control variables in Table 12 exhibit similar signs and levels of significance to those reported in Table 8 and reinforce the directional and statistical relationships identified in Table 8.

Table 11. Alternative measure of disparity with addition managerial variables—Buy before the good news disclosures.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0-10] (2)	CAR [0-20] (3)	CAR [0-30] (4)	CAR [0-40] (5)	CAR [0-50] (6)	CAR [0-5] (7)	CAR [0-10] (8)	CAR [0-20] (9)	CAR [0-30] (10)	CAR [0-40] (11)	CAR [0-50] (12)
SURPRISE	0.005 (0.130)	0.009 ** (0.018)	0.041 *** (0.000)	0.076 *** (0.000)	0.082 *** (0.000)	0.005 (0.130)						
ChgEARNINGS							-0.000 (0.990)	-0.005 * (0.074)	0.004 (0.346)	0.008 (0.136)	0.007 (0.240)	0.004 (0.471)
CPS ₋₁	0.201 (0.880)	1.868 (0.223)	5.131 *** (0.008)	4.686 * (0.057)	5.096 * (0.063)	0.201 (0.880)	-0.17 (0.890)	0.821 (0.564)	2.423 (0.194)	0.803 (0.746)	-0.088 (0.975)	2.532 (0.369)
CPS ₋₁ *SURPRISE	0.026 (0.267)	0.099 *** (0.000)	0.182 *** (0.000)	0.263 *** (0.000)	0.318 *** (0.000)	0.026 (0.267)						
CPS ₋₁ *ChgEARNINGS							0.016 (0.412)	-0.001 (0.980)	0.006 (0.851)	-0.034 (0.400)	-0.047 (0.289)	-0.049 (0.286)
ACCRUALS	2.516 (0.455)	5.552 (0.154)	10.269 ** (0.036)	5.088 (0.415)	-1.417 (0.839)	2.516 (0.455)	3.666 (0.273)	6.938 * (0.074)	13.546 *** (0.008)	11.390 * (0.092)	5.392 (0.472)	13.728 * (0.074)
LnBUY	0.025 (0.709)	0.058 (0.456)	0.301 *** (0.002)	0.353 *** (0.005)	0.452 *** (0.002)	0.025 (0.709)	0.03 (0.651)	0.065 (0.390)	0.298 *** (0.003)	0.355 *** (0.008)	0.443 *** (0.003)	0.420 *** (0.006)
OCFPS ₋₁	-0.056 (0.428)	-0.083 (0.310)	-0.402 *** (0.000)	-0.415 *** (0.002)	-0.381 *** (0.010)	-0.056 (0.428)	-0.057 (0.345)	-0.078 (0.262)	-0.330 *** (0.000)	-0.412 *** (0.001)	-0.377 *** (0.006)	-0.338 ** (0.014)
FIRMSIZE	-0.036 (0.895)	-0.146 (0.643)	0.01 (0.980)	-0.499 (0.323)	-0.344 (0.541)	-0.036 (0.895)	0.025 (0.923)	-0.056 (0.853)	0.183 (0.643)	-0.155 (0.767)	0.121 (0.836)	0.132 (0.825)
LnMB	-0.102 (0.749)	-0.155 (0.673)	0.295 (0.522)	0.869 (0.141)	1.102 * (0.094)	-0.102 (0.749)	-0.084 (0.777)	-0.078 (0.823)	0.192 (0.672)	0.604 (0.316)	0.745 (0.266)	1.175 * (0.086)
LEVERAGE ₋₁	0.041 *** (0.009)	0.048 *** (0.008)	0.063 *** (0.006)	0.077 *** (0.008)	0.085 *** (0.009)	0.041 *** (0.009)	0.041 *** (0.007)	0.041 ** (0.019)	0.056 ** (0.015)	0.066 ** (0.031)	0.073 ** (0.032)	0.069 ** (0.047)
RETVOL	0.187 (0.545)	0.285 (0.424)	0.886 ** (0.048)	1.458 ** (0.011)	2.936 *** (0.000)	0.187 (0.545)	0.525 * (0.063)	0.668 ** (0.041)	2.174 *** (0.000)	4.088 *** (0.000)	5.685 *** (0.000)	6.548 *** (0.000)
Δ RETVOL	-1.322** (0.000)	-1.886 *** (0.000)	-4.149 *** (0.000)	-5.017 *** (0.000)	-5.364 *** (0.000)	-1.322 *** (0.000)	-1.797 *** (0.000)	-2.403 *** (0.000)	-6.000 *** (0.000)	-8.689 *** (0.000)	-9.382 *** (0.000)	-10.526*** (0.000)
CEOTENURE	-0.002 (0.973)	0.051 (0.388)	0.095 (0.203)	0.119 (0.211)	0.087 (0.411)	-0.002 (0.973)	0.022 (0.649)	0.115 ** (0.043)	0.255 *** (0.001)	0.395 *** (0.000)	0.392 *** (0.000)	0.392 *** (0.000)
CEODUAL	0.872 (0.261)	2.086 ** (0.021)	4.168 *** (0.000)	3.565 ** (0.014)	3.869 ** (0.016)	0.872 (0.261)	1.032 (0.171)	2.363 *** (0.007)	5.270 *** (0.000)	5.838 *** (0.000)	6.279 *** (0.000)	5.360 *** (0.002)
INDDIR	0.002 (0.895)	0.005 (0.787)	0.01 (0.681)	-0.031 (0.329)	-0.047 (0.185)	0.002 (0.895)	0.006 (0.740)	0.012 (0.532)	0.023 (0.377)	-0.023 (0.498)	-0.04 (0.288)	-0.017 (0.657)
BOARDSIZE	0.099 (0.244)	0.072 (0.461)	0.208 * (0.091)	0.145 (0.355)	0.077 (0.660)	0.099 (0.244)	0.08 (0.329)	0.047 (0.618)	0.056 (0.652)	-0.127 (0.442)	-0.245 (0.182)	-0.212 (0.258)

Table 11. Cont.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5]	CAR [0–10]	CAR [0–20]	CAR [0–30]	CAR [0–40]	CAR [0–50]	CAR [0–5]	CAR [0–10]	CAR [0–20]	CAR [0–30]	CAR [0–40]	CAR [0–50]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	−2.544 (0.391)	−3.208 (0.349)	−12.054** (0.006)	−5.359 (0.330)	−8.624 (0.160)	−2.544 (0.391)	−3.737 (0.192)	−4.751 (0.152)	−14.490** (0.001)	−9.890 * (0.087)	−13.278** (0.039)	−18.384** (0.006)
Observations	766	766	766	766	766	766	779	779	779	779	779	779
Adjusted R ²	0.052	0.109	0.394	0.47	0.467	0.052	0.066	0.116	0.334	0.379	0.383	0.406

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR* [event period]. *SURPRISE* is earning surprise, defined as the difference between actual and expected earnings divided by actual earnings. The change in earnings *ChgEARNING* is the change between earnings per share for year t and year $t - 1$ divided by earnings per share year $t - 1$. *CPS* _{$t-1$} is the CEO pay slice of year $t - 1$, measured as the total CEO pay to the total pay of the top five executives; *CPS* _{$t-1$} **SURPRISE* is the interactive variable between *CPS* _{$t-1$} and *SURPRISE*; *CPS* _{$t-1$} **ChgEARNINGS* is the interactive variable between *CPS* _{$t-1$} and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using the modified version of the Jones (1991) model. Insiders' trading volume *LiBUY* is the natural logarithm of the buying volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market to book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LiMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE* _{$t-1$} is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ *RETVOL* equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day. The change in insider trading day minus *RETVOL*. CEO's tenure *CEOTENURE* is the number of years that a CEO has been at the helm of a firm. A dummy variable *CEODUAL* equals to one if the CEO holds the position of the chairman of the board; otherwise, it equals zero. Percentage of independent directors *INDDIR* is the number of independent directors divided by the total number of members of the board. *BOARDSIZE* is the total number of members of the board. The p -values are shown below the estimates in parentheses (). * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 12. Alternative measure of disparity with addition managerial variables—Sell before the bad news disclosures.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5]	CAR [0–10]	CAR [0–20]	CAR [0–30]	CAR [0–40]	CAR [0–50]	CAR [0–5]	CAR [0–10]	CAR [0–20]	CAR [0–30]	CAR [0–40]	CAR [0–50]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SURPRISE	−0.003 (0.289)	0.002 (0.610)	−0.006 (0.209)	−0.023 *** (0.000)	−0.018 ** (0.016)	−0.014 * (0.091)						
ChgEARNINGS							0.001 (0.391)	0.002 (0.325)	0.004 (0.133)	0.005 (0.169)	0.002 (0.547)	0.003 (0.537)
CPS _{$t-1$}	0.31 (0.646)	−0.711 (0.441)	−0.697 (0.577)	−0.262 (0.866)	1.95 (0.265)	1.234 (0.547)	0.133 (0.832)	−0.803 (0.371)	−0.968 (0.453)	0.444 (0.779)	2.306 (0.183)	1.378 (0.497)
CPS _{$t-1$} * <i>SURPRISE</i>	−0.089** (0.001)	−0.085 ** (0.017)	−0.128 *** (0.009)	−0.197 *** (0.001)	−0.170 ** (0.012)	−0.148 * (0.062)						
CPS _{$t-1$} * <i>ChgEARNINGS</i>							0.022 ** (0.012)	0.004 (0.743)	0.012 (0.484)	0.021 (0.345)	0.02 (0.403)	0.001 (0.959)
ACCRUALS	−7.644*** (0.000)	−8.890 *** (0.001)	−8.838 ** (0.012)	−16.070*** (0.000)	−18.910 *** (0.000)	−15.516 *** (0.007)	−7.307 *** (0.000)	−9.701 *** (0.000)	−9.132 ** (0.013)	−15.614*** (0.001)	−17.691*** (0.000)	−14.510 ** (0.013)

Table 12. Cont.

Dependent Variable:	SURPRISE					ChgEARNINGS						
	CAR [5] (1)	CAR [0-10] (2)	CAR [0-20] (3)	CAR [0-30] (4)	CAR [0-40] (5)	CAR [0-50] (6)	CAR [0-5] (7)	CAR [0-10] (8)	CAR [0-20] (9)	CAR [0-30] (10)	CAR [0-40] (11)	CAR [0-50] (12)
LnSELL	0.035 (0.479)	-0.022 (0.748)	-0.108 (0.240)	-0.263 ** (0.021)	-0.234 * (0.069)	-0.314 ** (0.037)	-0.014 (0.768)	-0.106 (0.111)	-0.298 *** (0.002)	-0.434 *** (0.000)	-0.390 *** (0.003)	-0.503 *** (0.001)
OCFPS ₋₁	0.004 (0.882)	0.011 (0.783)	0.047 (0.389)	0.077 (0.251)	0.117 (0.125)	0.137 (0.125)	0.028 (0.265)	0.021 (0.554)	0.101 * (0.051)	0.104 * (0.099)	0.146 ** (0.035)	0.139 * (0.088)
FIRMSIZE	-0.121 (0.298)	-0.405 ** (0.011)	-0.289 (0.178)	-0.283 (0.285)	-0.276 (0.358)	-0.26 (0.460)	-0.221 ** (0.042)	-0.567 *** (0.000)	-0.513 ** (0.022)	-0.444 (0.103)	-0.423 (0.157)	-0.399 (0.255)
LnMB	-0.252 (0.195)	-0.281 (0.290)	-0.629 * (0.081)	-0.42 (0.344)	-0.254 (0.613)	-0.709 (0.228)	-0.204 (0.249)	-0.155 (0.542)	-0.45 (0.217)	-0.133 (0.765)	-0.018 (0.972)	-0.464 (0.418)
LEVERAGE ₋₁	-0.004 (0.673)	-0.015 (0.207)	-0.015 (0.342)	-0.02 (0.323)	-0.024 (0.297)	-0.008 (0.752)	-0.006 (0.502)	-0.028 ** (0.023)	-0.025 (0.155)	-0.025 (0.239)	-0.029 (0.207)	-0.018 (0.508)
RETVOL	-0.706*** (0.000)	-0.971 *** (0.000)	-1.505 *** (0.000)	-1.555 *** (0.000)	-1.328 *** (0.000)	-1.778 *** (0.000)	-0.801 *** (0.000)	-1.493 *** (0.000)	-2.418 *** (0.000)	-2.528 *** (0.000)	-2.063 *** (0.000)	-2.774 *** (0.000)
Δ_RETVOL	1.169 *** (0.000)	1.548 *** (0.000)	2.725 *** (0.000)	3.069 *** (0.000)	2.796 *** (0.000)	3.408 *** (0.000)	1.422 *** (0.000)	2.652 *** (0.000)	4.534 *** (0.000)	5.062 *** (0.000)	4.448 *** (0.000)	5.617 *** (0.000)
CEOTENURE	-0.039 * (0.079)	-0.041 (0.177)	-0.078 * (0.061)	-0.023 (0.659)	0.058 (0.318)	0.071 (0.297)	-0.041 * (0.051)	-0.039 (0.192)	-0.105 ** (0.014)	-0.042 (0.425)	0.052 (0.366)	0.055 (0.412)
CEODUAL	-0.256 (0.396)	0.028 (0.946)	-0.692 (0.216)	-1.03 (0.136)	-1.707 ** (0.030)	-1.437 (0.116)	-0.306 (0.274)	-0.515 (0.200)	-1.539 *** (0.008)	-1.895 *** (0.008)	-2.373 *** (0.003)	-2.110 ** (0.021)
INDDIR	0.004 (0.968)	0.009 (0.490)	-0.005 (0.782)	0.011 (0.583)	0.033 (0.161)	0.013 (0.631)	-0.0001 (0.987)	0.021 * (0.073)	0.01 (0.564)	0.021 (0.293)	0.042 * (0.061)	0.023 (0.386)
BOARDSIZE	0.045 (0.336)	0.066 (0.300)	0.085 (0.322)	0.077 (0.466)	0.049 (0.685)	0.028 (0.844)	0.03 (0.483)	0.086 (0.164)	0.035 (0.692)	-0.012 (0.912)	-0.008 (0.946)	-0.034 (0.806)
Constant	1.988 (0.221)	5.777 *** (0.010)	8.155 *** (0.007)	8.079 ** (0.030)	4.831 (0.252)	8.557 * (0.083)	3.887 ** (0.012)	8.103 *** (0.000)	13.213 *** (0.000)	12.518 *** (0.002)	8.464 ** (0.046)	13.084 *** (0.009)
Observations	1185	1185	1185	1185	1185	1185	1240	1240	1240	1240	1240	1240
Adjusted R ²	0.065	0.055	0.078	0.083	0.058	0.046	0.072	0.107	0.146	0.124	0.09	0.084

Notes: This table reports the OLS estimation for insider trading of 6 event windows from [0–5] to [0–50] and earning proxies *SURPRISE* and *ChgEARNINGS*. The dependent variable is cumulative abnormal return *CAR [event period]*; *SURPRISE* is the change between earnings per share for year t and year $t - 1$ divided by earnings per share year $t - 1$. *CPS_{−1}* is the CEO pay slice of year $t - 1$, measured as the total CEO pay to the total pay of the top five executives; *CPS_{−1} * SURPRISE* is the interactive variable between *CPS_{−1}* and *SURPRISE*; *CPS_{−1} * ChgEARNINGS* is the interactive variable between *CPS_{−1}* and *ChgEARNINGS*; *ACCRUALS* is the measure of abnormal accrual using the modified version of the Jones (1991) model. Insiders' trading volume *LnSELL* is the natural logarithm of the selling volumes made by insiders. *OCFPS* is operating cash flow per share. *FIRMSIZE* is defined as the natural logarithm of total market capitalization. Market to book value *MB* is defined as the book value divided by the total market capitalization of a stock. *LnMB* is the natural logarithm of *MB*. Financial leverage *LEVERAGE_{−1}* is the ratio of total debt over total assets in the previous year. Return volatility of a stock *RETVOL* is the standard deviation of daily stock returns computed over trading days [−250, −126] relative to the insider trading day. The change in standard deviation Δ_RETVOL equals the standard deviation of the firm's daily stock returns computed over trading days [−125, −1] relative to the insider trading day minus *RETVOL*. CEO's tenure *CEOTENURE* is the number of years that a CEO has been at the helm of a firm. A dummy variable *CEODUAL* equals to one if the CEO holds the position of the chairman of the board; otherwise, it equals zero. Percentage of independent directors *INDDIR* is the number of independent directors divided by the total number of members of the board. *BOARDSIZE* is the total number of members of the board. The p -values are shown below the estimates in parentheses 0. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

6. Conclusions

This research aims to explore the connection between executive pay disparity and insider trading returns prior to corporate earnings disclosures. Previous studies have suggested that insider trades convey private information and act as signals for firm value. In this study, we specifically examine the influence of the executive pay disparity on abnormal returns generated from insider purchases before both good and bad earnings news.

Our study analyzes earnings announcements from 2008 to 2019 for the 340 largest non-financial firms listed on major indices in eight developed markets: US (DJIA), UK (FTSE100), Australia (ASX50), Canada (TSX60), Germany (DAX), France (CAC40), Belgium (BEL20), and the Netherlands (AEX). These markets have robust corporate governance frameworks and investor protection measures, such as the Sarbanes-Oxley Act. The selected firms represent 60.75% of the total market capitalization in these countries. We chose to begin our study in 2008 because it provided comprehensive and consistent data, and it was a significant year for insider transactions. The 2008 financial crisis prompted increased scrutiny and tighter regulations on insider behavior and disclosure requirements.

Our results provide contrasting evidence regarding the relationship between executive pay disparity and insider abnormal returns prior to earnings disclosures. The impact of executive pay disparity on the profitability of insider trading varies depending on the type of transaction, whether it is a purchase before good earnings news or a sale before bad earnings news.

On the one hand, we find evidence of a significant positive association between executive pay disparity and insider cumulative abnormal returns from insider purchases before good earnings news. From a managerial power perspective, the positive impacts of executive pay disparity on insider purchase returns can be attributed to several factors. Firstly, a large executive pay disparity signifies a significant power and compensation difference within the organization. Insiders, particularly CEOs, have access to superior information and are more likely to exploit it through insider purchases, capitalizing on positive earnings news. Secondly, firms with a larger executive pay disparity often face higher CEO entrenchment and succession risk, leading insiders to strategically time their purchases with positive earnings news, anticipating a brighter future. This alignment between insider purchases, executive pay disparity, and good earnings news contributes to higher returns. Additionally, a larger executive pay disparity signals a skilled and experienced CEO, increasing investor confidence and attracting more investors, driving up insider purchase returns. Lastly, a large executive pay disparity may enable CEOs to act opportunistically and exploit good earnings news for personal gain through insider purchases, resulting in higher returns.

Conversely, our analysis of insider sales before bad earnings news reveals a significant negative relationship between executive pay disparity and insider abnormal returns. From a tournament hypothesis perspective, the negative impacts of executive pay disparity on insider sale returns can be explained by several factors. Firstly, a high executive pay disparity indicates concentrated power and control, making it harder for insiders, including the CEO, to engage in opportunistic behavior like selling stocks based on inside information. This deters insiders in firms with a high executive pay disparity from exploiting bad earnings news through insider sales. Secondly, firms with large executive pay disparities tend to have stronger corporate governance practices and stricter regulatory oversight. This discourages insiders from engaging in fraudulent or manipulative practices, resulting in lower insider sale returns. Thirdly, a high executive pay disparity suggests lower succession risk and greater alignment of the CEO's interests with the company's long-term success. Insiders, including the CEO, are more likely to hold onto their shares, anticipating improved future performance in the longer term, which reduces insider selling activity and lowers sale returns. In summary, according to the tournament hypothesis, the negative impacts of executive pay disparity on insider sale returns indicate that firms with greater executive pay disparity discourage opportunistic behavior and the exploitation of negative news through insider sales.

We also find that insider purchases before good news exhibit a strong positive relationship between insider returns and earnings surprises, whereas insider sales before bad news demonstrate a weaker negative relationship between insider returns and earnings surprises. Several factors contribute to the contrasting and weaker relationship between insider sale returns before bad news and insider purchase returns before good news. First, information asymmetry arises because insiders possess negative information that may not be widely known, delaying the market's incorporation of the negative news. Second, different motivations drive insider purchases (confidence in company prospects) and sales (financial needs, diversification, pessimistic views), diluting the relationship. Third, the market response may differ, with positive surprises yielding immediate stock price increases, while negative surprises receive a more subdued or delayed reaction. Lastly, timing and reporting discrepancies occur as insiders have timely access to positive information, enabling pre-public purchases, whereas negative news may take longer to materialize, resulting in delayed sales.

In addition, as we explore the impacts of other control variables on insider abnormal returns, we find that the trading volume of insiders' purchases is positively related to insider purchase abnormal returns. This is likely indicating that larger stock volume purchases can influence outsiders to imitate the trades, leading to increased stock prices and improved insider returns. Conversely, a decrease in insider trading volume is associated with higher insider returns from sales transactions. Insiders tend to sell more during periods of low trading volume, leveraging their valuable information to maximize returns. Strategic timing of sales allows insiders to take advantage of their insights and achieve higher returns compared to average market conditions. During periods of low trading volume, the impact of each individual's selling becomes more significant, attracting attention and potentially signaling stronger conviction, resulting in higher returns. Conversely, higher insider trading volume, reflecting broader selling participation, dilutes the impact of specific insider sales, leading to more average or lower returns. Increased selling activity during high trading volume may also involve insiders selling for reasons unrelated to private information.

Furthermore, we find that higher stock return volatility is associated with higher insider purchase returns, while a negative relationship exists between insider purchase returns and the change in stock return volatility. This can be explained as follows: Firstly, a decrease in return volatility indicates a more stable and less volatile market, limiting opportunities for insiders to exploit mispriced securities or market inefficiencies. Secondly, insiders are less successful in generating abnormal returns when market conditions become more predictable or when uncertainty levels decrease. Conversely, we observe that high stock return volatility is associated with lower insider sale returns, and there is a positive relationship between insider sale returns and the change in stock return volatility. This suggests that insiders in firms with low but increasing equity risk are more inclined to exploit earnings information to benefit from their stock sales.

In our robustness tests, we incorporate corporate governance-related variables to account for the influence of other managerial characteristics on executive pay disparity, and utilize the CEO pay slice as an alternative measure of executive pay disparity. The coefficients in our robustness models maintain the same sign, statistical significance, and similar magnitude as those in our main results.

We believe we are the first to provide evidence of the relationship between executive pay disparity and insider trading prior to corporate earnings disclosures. Our results are consistent with the arguments of Bebchuk et al. (2011) and Kale et al. (2009). In particular, Bebchuk et al. (2011) show that a large degree of executive pay disparity suggests the high entrenchment of an incumbent CEO, weakening the board. We complement their study by showing that insiders are more likely to exploit optimistic future earnings news for their purchases before the good news disclosure in firms with high pay disparity. In contrast, Kale et al. (2009) and Ali and Hirshleifer (2017) argue that a high executive pay disparity represents a larger incentive for other executives competing for the CEO position

to leave the board, improving overall board quality and reducing opportunism. We find a negative relationship between executive pay disparity and insider sale returns before the bad earnings news disclosure, that is higher pay decreases insider returns.

In addition to the theoretical contributions, we believe that this study offers several practical implications for corporate governance, policymakers, and investors. Understanding the link between executive pay disparity and insider trading returns provides actionable insights for companies wishing to refine executive compensation structures. Specifically, companies can mitigate potential conflicts of interest and reduce the risk of opportunistic insider trading by aligning compensation practices more closely with long-term shareholder value. For policymakers and regulators, the findings underscore the need to develop regulatory frameworks that promote fairness and transparency in executive compensation. Such frameworks could help enhance market integrity and reduce imbalances that might lead to unfair trading advantages. Lastly, investors too can benefit by using executive pay disparity as a signal of insider behavior that may influence stock performance. By recognizing these dynamics, investors can make more informed strategic investment decisions, particularly by excluding firms where compensation inequality might indicate potential insider trading risk. These practical insights have the potential to improve decision-making across various domains, ultimately fostering more stable and transparent financial markets.

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Review

CFO (Chief Financial Officer) Research: A Systematic Review Using the Bibliometric Toolbox

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Abstract: The chief financial officer (CFO) is a crucial executive position in an organisation, responsible for overseeing the financial operations and strategy of the company. Despite rising interest among academics and practitioners, the literature corpus on CFO research remains largely fragmented, which warrants the unpacking of the underlying intellectual knowledge structure of the domain. In response, this study aims to provide a concise overview of the trends and science relating to CFO research, comprehend potential gaps in the literature, and highlight crucial future research pathways. A quantitative bibliometric overview of 669 research articles from 1982 to 2022 provides a spectrum of intellectual clout that helps decipher performance trends and delineates six significant clusters of knowledge in CFO research. We selectively discuss the empirical findings and theoretical and conceptual advancements within each cluster. This study offers recommendations for future research, emphasising the growing role of CFOs in leadership and addressing the fragmentation in current research. The findings and contributions of this study could further elevate CFOs' importance in the C-suite.

Keywords: bibliometrics; *VOSViewer*; chief financial officer (CFO); temporal analysis; review

1. Introduction

The TMT (top management team) greatly influences any company's growth trajectory (Boeker 1997). The term "top management team" (TMT) is commonly used to refer to the group of senior executives at a company's strategic apex who are charged with setting and implementing the company's overarching strategic direction and performance (Barker et al. 2001). Therefore, TMTs play a pivotal role as a crucial analytical unit in research into workplace dynamics (Ng et al. 2019). Myriad literature on TMT exists (Carpenter et al. 2004; Abatecola et al. 2013), with the majority of literature centred around chief executive officers (CEOs) (Yu 2023; Menz 2012). The most senior individual involved in the financial function of an organisation is the chief financial officer (CFO). CFOs are frequently held accountable "for managing all financial aspects of the organisation, including managing budgets, preparing financial statements, identifying financial risks and controls, and presenting financial information" (Malaysian Institute of Accountants 2016). Mian (2001) assiduously described the CFO in the context of US corporations. He added that the chief financial officer (CFO) is ultimately in charge of designing and implementing the company's policy

decisions apropos financial performance. Successful CEOs acknowledge that having a CFO who can assist in managing the difficulties in a firm is not just desirable but is a requisite (Favaro 2001). However, the academic research that has dominated for more than 40 years does not coincide with the practitioners' perspective. Instead, the scholarly argument has supported that a CFO's responsibility can vary over a wide range of operations. From traditional financial reporting (Uddin and Gillett 2002) to more sophisticated strategic decisions (Hennessy and Chemla 2022), such as innovation in accounting (Naranjo-Gil et al. 2009), value-based management (Burkert and Lueg 2013), and participation of women in leadership (Caselli and Di Giuli 2010), CFOs are becoming more prolific.

Lately, or not long ago, there has been an outpouring of research on CFOs and related topics. The first article (as per Scopus search results) on CFO, "A reasoned approach to hospital planning in an uncertain world", was published in 1982 by Bruton (1982). The area has developed over the past four decades, and numerous sub-contexts and sub-areas have emerged. Most early CFO research articles concentrated on the functioning and advantages of having a CFO and how they affected a company's success with adopting innovations. The research area has grown conceptually and methodologically throughout time, providing opportunities for profound knowledge of the CFO.

As the chief financial officer (CFO) role is crucial to businesses and the number of scholarly articles on the subject has been rising continuously, it is not astounding that researchers have begun integrating the existing body of information to shed light on CFOs. A systematic literature review method has been used in some studies, but it is not closely related to CFOs. For example, Peterson et al. (2003) explored how a CEO's personality can affect the dynamics of the TMT, which can affect a firm's financial performance. In addition, Papadakis and Barwise (2002) further elaborated on the impact of TMT characteristics on strategic decision-making processes. They discovered that CEOs and other TMT participants impact these processes in various ways. Additionally, a detailed review of CEO activism was conducted by Rumstadt and Kanbach (2022). Other areas of research include CEO duality and performance of the firm (Yu 2023), the relationship between CEO characteristics and incentives and CSR (Velte 2020), the impact of CEO on product innovation (Back and Bausch 2019), the CEO hubris and related constructs (Park and Yoo 2017), theories and examples of independent directors' roles in Indian corporate law and governance (Bose 2009), review of the several TMT members' functional roles (Menz 2012), CEO compensation determinants (Winschel and Stawinoga 2019), review on CEO characteristics (Altarawneh et al. 2020), the personality factor of TMT (Abatecola et al. 2013), and the board chair's role (Banerjee et al. 2020).

To our limited knowledge, only three review articles that have synthesised research on CFOs exist in the literature. However, these studies are constrained in many different ways. In particular, Habib and Hossain (2013) reviewed the literature on the relationship between various CEO/CFO characteristics and qualities of accounting information. Due to the lack of a systematic approach, the review is not easily reproducible. Hiebl's (2017) review covered only 17 papers and unpacked key perspectives of finance managers in family firms through the upper echelons' theoretical lens. In addition, Uhde et al. (2017) reviewed extant research on board monitoring of the CFO. Their article, one of the most thorough assessments to date, was limited to a content analysis of 65 articles published in 26 journals. It unravelled the key roles, methods, a comprehensive model, and constructs of CFOs. Cumulatively, it seems that existing evaluations on CFOs are restricted to contextual (e.g., family business) insights gleaned from traditional review approaches (e.g., content analysis) with a relatively small review sample (e.g., up to 17 and 26 articles).

A circumstance like this is considered troublesome, as scholarly literature reviews are designed to serve as a roadmap for further investigation. When such reviews are too narrow in their focus and methodology, a new (better) review that fixes the existing problems and sets academics back on the correct track is necessary (Lim et al. 2021; Paul et al. 2021). The voids mentioned above inspired the present review to be initiated.

In this vein, this article identifies five significant ways the abovementioned reviews on CFOs might be improved. First, this article is the first attempt to conduct a bibliometrics analysis on CFO research. Second, the current review covers data up to 2022. Third, using performance analysis and publication trends, this review provides fresh perspectives on the foci mentioned above, illuminating previously unexplored corners of the academic CFO literature. Fourth, following Donthu et al.'s (2021a) suggestions, this review provides a holistic perspective of the CFO's history, development, and outlook by bibliographic coupling and temporal analysis. Fifth and finally, by synthesising the topics that emerged during this analysis, we hope to provide a comprehensive overview of the themes that make up the CFO knowledge base to provide an apparent, concise synthesis of CFO-relevant research for future studies.

Conclusions that can lead to the development of new scholarships related to chief financial officers could be gleaned from a review of the scholarly literature on the topic and by comprehending the strategic and pre-emptive roles that CFOs play. Ruminating the strategic relevance of a CFO's position, flanked by the significant number of manuscripts published, a review may also aid scholars in understanding CFO research without having to look through an extensive body of work (Donthu et al. 2021a).

This work may establish a focal point for the developing domain of CFO research, allowing academics to assess its significance and address potential future research topics by carefully examining relevant studies. This bibliometric variant of systematic review analyses the corpora of literature on CFO by identifying the most prolific contributors and constituents to delineate the leading trends and future trajectories of research.

To facilitate the reader's understanding, the structure of this paper is organised as follows. Section 2 provides an overview of the theoretical background, discussing key frameworks and literature relevant to CFO research. Section 3 outlines the methodology, including the dataset and period under analysis and the statistical tools used for the study. Section 4 presents the main findings. Then, Section 5 presents a detailed discussion. Finally, Section 6 concludes the paper, offering insights into the implications of the findings for both academia and practitioners, along with limitations and suggestions for future research.

2. CFO Research: Background

The known literature corpus of CFO research dates back to 1982. The first paper, "A reasoned approach to hospital planning in an uncertain world", by Bruton (1982), was a conceptual article that proposed an approach that would incorporate the chief financial officer of a hospital into the planning process. He suggested that hospitals create a comprehensive strategic plan by including input from all hospital management team members, including those in charge of the finances. After this, there was gradual progress in the trajectory of CFO research. Within our limited knowledge, we found no review article that sedulously talked about the CFO. A plethora of studies have assiduously explored CEO characteristics. For example, Yu (2023) meticulously evaluated empirical studies investigating the association between board leadership structure and firm performance. The results revealed mixed findings. Carpenter et al. (2004) worked on the upper echelons theory and projected future research direction. A systematic review of the determinants of CEO compensation by Winschel and Stawinoga (2019), the decision process of top management by Abatecola et al. (2013), the function of the board chair in the performance of the firm by Banerjee et al. (2020), the activism of CEO in a firm by Rumstadt and Kanbach (2022), the influence of CEO on the top management team by Peterson et al. (2003), and the interaction of TMT and CEO in the strategic decision-making process by Papadakis and Barwise (2002) entail the literature on CFOs. Other studies corroborate the impact of chief sustainability officers and CEOs on CSR (Velte and Stawinoga 2020; Velte 2020). Some articles found a positive relationship (Banker et al. 2011; Krishnan et al. 2011; Jiang et al. 2008), while others adjudicated the association between CFO and firm performance to be insignificant (Gavious et al. 2012; Liu et al. 2016). The manuscript of Datta and Iskandar-Datta (2014) relied on the theory of the upper echelon (Hambrick and Mason 1984) and

reported that “strategic” CFOs with a top-notch MBA frequently demand higher overall remuneration. Accordingly, grounded on a framework of the upper echelon in tandem with double standards of competence theories (Foschi 1996), female leaders have been shown to significantly and positively impact firm performance (Chadwick and Dawson 2018). In addition, the CFO impact has been explored in different contexts. For example, Li and Zeng (2019) examined the effect of a female CFO on stock price, the association between a firm’s CFO and its cash-holding policies was investigated by Li and Zeng (2019), and the adoption of innovations in business was explored by Esteves (2009) and Naranjo-Gil et al. (2009). Research has also investigated how the passage of the Sarbanes–Oxley Act has impacted the CFO (Collins et al. 2009; Hermanson and Ye 2009; Li et al. 2010; Krishnan et al. 2011).

Further, extant research has identified the causes of CFO compensation (Hoitash et al. 2012; Datta and Iskandar-Datta 2014), outcomes of CFO compensation (Alali 2011), and the capriciousness of CFO compensation in Australia based on managerial power and the incentive alignment theory (Duong and Evans 2015). Another thread of research identified the CFO turnover, finding an association between irregular errors and CFO turnover (Hennes et al. 2008) and the relationship between senior executive turnover and the contribution of managers to earnings guidance provision (Brochet et al. 2011). In addition, Feldmann et al. (2009) examined the association between financial restatement and audit fees by incorporating the CFO turnover as a moderator. Notably, some studies have identified the CFO’s characteristics as influencing a variety of strategic outcomes. Ham et al. (Graham et al. 2015) argued that inaccurate reporting is predicted by narcissism, resulting in a lower standard of internal control and a greater likelihood of restatement. The degree of sensitivity associated with the CFO gender to the risk faced by a firm according to the accounting conservatism principle (Francis et al. 2015). In addition, research has also explored the CFO and audit relationship (Gibbins et al. 2007; McCracken et al. 2008; Salleh and Stewart 2012). Moreover, the age and education of the CFO proved to be the crucial determinants of the optimal capital structure and sophisticated capital budgeting method (Brunzell et al. 2013). Likewise, the chief financial officer’s social capital was found to impact private debt’s cost and terms (Fogel et al. 2018).

3. Review Methodology

Researchers have utilised a variety of approaches to perform and conduct systematic literature reviews (Preuße 2012; Borozan et al. 2022; Khan et al. 2022; Patel et al. 2022; Pattnaik et al. 2020), such as framework-based reviews (Kajol et al. 2022), bibliometric reviews (Chopra et al. 2021; Fakhar et al. 2023; Ishrat et al. 2023; Rashid et al. 2024), theory-based reviews (Tanrikulu 2021), hybrid reviews (Dabić et al. 2020; Khan et al. 2024), and method-based reviews (Diwanji 2023).

This systematic review adopts a pathway of mapping and gauging a relatively large dataset of 669 articles by adopting the methodical approach adopted by Sharma et al. (2022) and Boubaker et al. (2023), which is essentially a quantitatively informed bibliometric approach. We chose bibliometric and content analysis techniques, which are text-mining methods, as they offer the benefits of flexibility and the capacity to display statistical and contextual data succinctly (Tiwary et al. 2021). We first devise research questions, decide on the informatic framework for data collection, and then list and explain the data analysis tools employed in this review.

3.1. Formulation of Research Questions

A clear and crisp formulation of research questions is required to build a successful systematic review (Vrontis and Christofi 2021). While formulating our research questions, we followed a standard procedure adopted by state-of-the-art bibliometric variants (Goodell et al. 2021; Kumar et al. 2022a; Rasul et al. 2022) of systematic reviews for (1) highlighting the current state of the knowledge, (2) unravelling the realities and intellectual frontiers, (3) classifying the knowledge base, and (4) shedding light on potential future research

directions concerning CFO research. These preliminary objectives ultimately helped us carve out four overarching research questions:

RQ1: What are the publication, citation trends, and most prolific articles, authors, journals, and countries in CFO research?

RQ2: What main themes (structure of knowledge) exist within CFO research?

RQ3: What are the major topics for CFO research?

RQ4: What are the future research lines in CFO research?

3.2. Data Collection

In line with the objectives of this review, we endeavoured to explore the trends and intellectual structure of the existing knowledge in the research domain of CFOs.

To endow a structural and objective outlook to our review, we incorporated the review guiding framework (see Figure 1) adopted by Tiwary et al. (2021) to finalise a dataset in which several quantitative bibliometric tools are used to map CFO research. Initially, Scopus was selected, as it is the most exhaustive and largest academic database, consisting of more than 40,000 journals across disciplines (Sureka et al. 2022). Afterwards, we searched for the keywords “CFO” OR “Chief Financ* Offic*” in Scopus’s abstract, title, and keyword options. In the first search, our query identified 6322 documents. Then, to identify the most relevant papers for final inclusion, we chose to apply filters on three levels. First, we used two filters: (1) document type and (2) source type. For document type, we decided only to go for peer-reviewed articles (avoiding reviews and other non-peer-reviewed publications); this choice is consistent with Kumar et al. (2022b), hence ensuring rigour. For source type, the source was kept as journals only (avoiding conference proceedings, etc.); this choice is consistent with Srivastava et al. (2022), resulting in a total of 3809 documents. Second, we applied two further filters: (1) subject and (2) language. For the subject, we kept the choice limited to subject streams that are relevant for CFO research, i.e., business, econometrics, management, economics, and finance. This process resulted in 842 documents. Third, two authors undertook a manual screening process individually. They screened all the articles by going through the titles, keywords, and abstracts of all the 842 documents returned from the second level. This screening process resulted in the final number of 669 articles while assuring inter-rater reliability (Tinsley and Weiss 2000; Fink 2014) of 0.95, which further enhanced the objectivity and systematicity of the process. The three-step filtering process resulted in 669 articles, which were finally used to apply quantitative tools taken from the bibliometric toolbox.

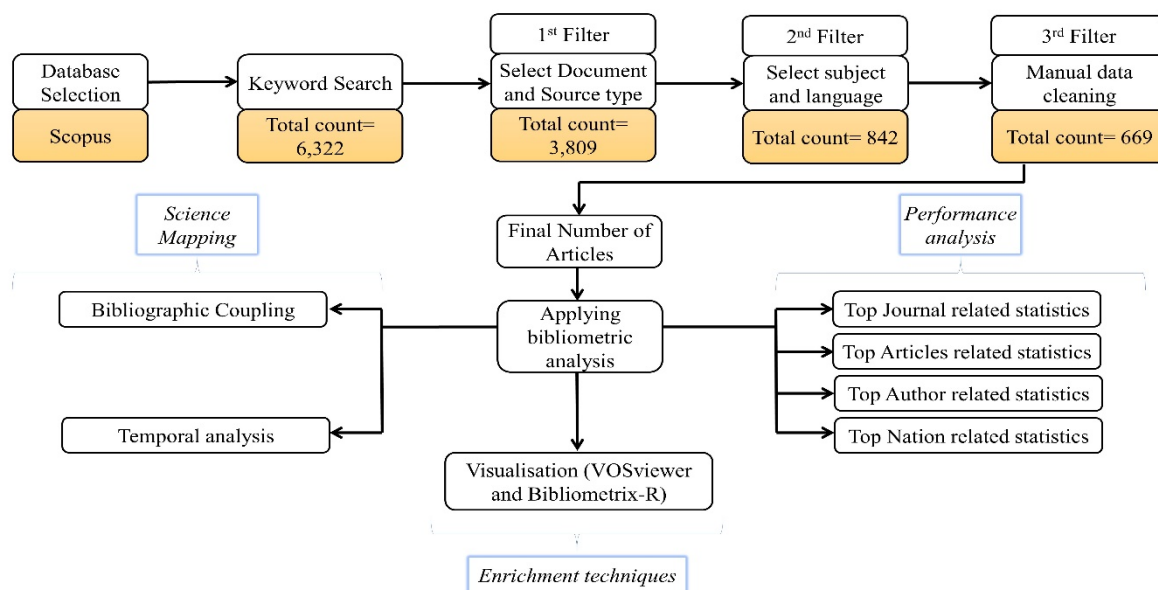


Figure 1. Overview of the methodology adopted for the paper. Source: researcher’s own elaboration.

3.3. Bibliometric Tools and Software for Data Analysis

A statistical and unbiased method of analysing the bibliographic information for a body of literature is called bibliometric analysis (Tomar et al. 2021; Kasaraneni and Rosaline 2022). Through bibliometric tools (Donthu et al. 2021a), bibliometric analysis investigates the key trends among the research components and constituents of a subject corpus, looks at changes and advancements in the body of knowledge, and assesses the scientific calibre of pertinent publications (Cobo et al. 2011; Zhang et al. 2021a). Science mapping and performance analysis are two significant categories of analyses included in the bibliometric inquiry (Donthu et al. 2021a). Performance analysis offers an updated picture of how the review area has developed despite being descriptive (Jain et al. 2021). As a result, the quality tracing of publications is made more accessible. It also provides insights into which journals or authors publish widely in the field and who receives many scholarly citations (Capizzi et al. 2022). Science mapping techniques offer a different viewpoint on the subject (Liu et al. 2013). Any set of articles can be analysed as long as there are connections in the examined corpus. Science mapping has a more extensive scope than a structured literature review and seeks to identify trends in the corpus of knowledge (Zupic and Čater 2015).

In the current review, we first examined and orchestrated the statistics related to journals, articles, authors, and nations for CFO research, highlighting the most prolific journals, the most productive authors, the most cited articles, and the most productive countries. Then, we employed (1) bibliographic coupling, which identifies emerging trends in the field and facilitates data analysis beyond the status quo (Boiko 2022), and (2) temporal analysis, which depicts how the study field has evolved conceptually, intellectually, and socially (Aria and Cuccurullo 2017).

We used free and open-access computer software with specific capabilities and limitations to undertake bibliometric analysis, including VOSviewer version 1.6.15 and Bibliometrix-R version 4.3.2 (van Eck and Waltman 2010; Aria and Cuccurullo 2017), which helped us visualise and gauge the bibliographic data and map out the relevant intellectual structure of the research domain. Over the course of 41 years, scholarly researchers have identified significant changes in CFO research [1982–2022 (December 31st)].

4. Results and Findings

4.1. Performance Trends (RQ1a)

The first step of our research was performance analysis, where we examined the leading researchers in the discipline, their publication patterns, and the significant journals that publish CFO-related research (Pinho et al. 2022; Rasul et al. 2022).

4.1.1. Publication and Citation Trends

Table 1 details the various metrics of publication and citation trends in CFO research.

First, publication trends in CFO research cover the periodic span of 41 years, and 1982 marks the beginning of this field of research (as per the Scopus database). Embarking in 1982, this field produced 669 peer-reviewed conceptual and empirical publications (TPs), appearing in 267 publication outlets, with an average productivity of 11.84 publications per year (PAY). Out of the 669 publications, 654 (or 97.76 percent) have been cited by other authors (TCPs). To date, 118 distinct single authors (ASAs) and 1244 distinct co-authors (ACAs) have each contributed to 129 single-authored publications (SAs) and 540 co-authored articles (CAs) in CFO research.

Second, citation trends in CFO research depict that this field has garnered 17,094 citations (TCs), with an average citation per publication of 25.55 (TC/TP). Furthermore, the field's h-index (citation impact) is 57, indicating that 57 (h) publications have at least received 57 (h) citations.

Table 1. Trends for citations and publications.

Description	Results
<i>Publication-related metrics</i>	
Total publications (TPs)	669
Total cited publications (TCPs)	654
Total sources (journals)	267
Article (e.g., conceptual and empirical)	669
Number of active years (NAYs)	34
Productivity per active year (PAY)	11.84
Number of contributing authors (NCAs)	1362
Author of single-authored document (ASA)	118
Author of co-authored document (ACA)	1244
Single-authored publications (SAs)	129
Co-authored publications (CAs)	540
<i>Citation-related metrics</i>	
Total citations (TCs)	17,094
Average citations per publication (TC/TP)	25.55
<i>h-index</i>	57

Note: period of coverage = 1982 to December 2022. Source: researcher's own elaboration.

4.1.2. Most Prolific Journals (RQ1b)

Table 2 lists the sources of CFO research based on the number of articles published, the number of citations obtained, and the journal's *h-index*. The most influential article was published in the *Journal of Financial Economics* (TC: 2903) with an *h-index* of 13. The other leading journals are the *Accounting Review*, *Journal of Accounting and Economics*, *Contemporary Accounting Research*, and *Accounting Horizons*.

Table 2. Most influential journals as per citation metric.

Journal	<i>h</i>	Number of Publications	Total Citations
<i>Journal of Financial Economics</i>	13	14	2903
<i>Accounting Review</i>	9	10	1205
<i>Journal of Accounting and Economics</i>	7	7	1048
<i>Contemporary Accounting Research</i>	11	15	848
<i>Accounting Horizons</i>	10	14	656
<i>Journal of Accounting Research</i>	6	7	596
<i>Accounting, Organizations and Society</i>	2	2	525
<i>Journal of Accounting and Public Policy</i>	6	11	455
<i>Accounting, Auditing & Accountability Journal</i>	1	1	417
<i>Journal of Finance</i>	3	3	385

Source: researcher's own elaboration.

4.1.3. Articles (RQ1b)

Table 3 illustrates the most influential article published in CFO research (as per the total citations). It is evident that Campello et al.'s (2010) manuscript "The real effects of financial constraints: Evidence from a financial crisis" is the most prolific article, with 906 (highest) citations. Kim et al.'s (2011) article "CFOs versus CEOs: Equity incentives and crashes" is the second most influential article, with 496 total citations. The other impactful articles are "The importance of distinguishing errors from irregularities in restatement research: The case of restatements and CEO/CFO turnover" (Hennes et al. 2008) with 478 total citations, "An empirical analysis of the levers of control framework" (Widener 2007) with 430 citations, and "Corporate environmental reporting: A test of legitimacy theory" (Wilmsmurst and Frost 2000) with 417 citations. Dichev et al. (2012) (TC: 416), Brau and Fawcett (2006) (TC: 375), Beasley et al. (2005) (TC: 347), Jiang et al. (2010) (TC: 323), and Feng et al. (2011) (TC: 281) have also received a high number of citations.

Table 3. Most influential articles.

Article Citations	Title	Year	Local Citations	Global Citations	LC/GC Ratio (%)	Normalised Local Citations	Normalised Global Citations
Campello et al. (2010)	The real effects of financial constraints: Evidence from a financial crisis	2010	7	906	0.77	0.62	8.19
Kim et al. (2011)	CFOs versus CEOs: Equity incentives and crashes	2011	23	496	4.64	5.07	10.64
Hennes et al. (2008)	The importance of distinguishing errors from irregularities in restatement research: The case of restatements and CEO/CFO turnover	2008	40	478	8.37	10.30	8.23
Widener (2007)	An empirical analysis of the levers of control framework	2007	2	430	0.47	0.67	7.25
Wilmshurst and Frost (2000)	Corporate environmental reporting: A test of legitimacy theory	2000	1	417	0.24	7.00	5.21
Dichev et al. (2012)	Earnings quality: Evidence from the field	2013	0	416	0.00	0.00	6.76
Brau and Fawcett (2006)	Initial public offerings: An analysis of theory and practice	2006	5	375	1.33	0.55	4.86
Beasley et al. (2005)	Enterprise risk management: An empirical analysis of factors associated with the extent of implementation.	2005	3	347	0.86	0.43	4.92
Jiang et al. (2010)	CFOs and CEOs: Who has the most influence on earnings management?	2010	90	323	27.86	7.94	2.92
Feng et al. (2011)	Why do CFOs become involved in material accounting manipulations?	2011	77	281	27.40	16.99	6.03

LC/GC ratio (local to global ratio). Source: researcher's own elaboration.

4.1.4. Authors (RQ1b)

Based on our corpus, 1362 authors have published articles on CFO-related research. Table 4 displays the most influential authors according to the total citations and the number of publications. Campbell R. Harvey has received the most citations (TC: 1619), with an h-index and g-index of 6, making him the most influential author in CFO research. The second most impactful author, as per the total citations, is John R. Graham, with 1598 citations. The third influential author in the CFO-related research is Murillo Campello (TC: 906), followed by Yiwei Li (TC: 631), Shivaram Rajgopal (TC: 550), Jeong-Bon Kim (TC: 530), and Liandong Zhang (TC: 496). Geoffrey R. Frost and Trevor D. Wilmshurst have received the same number of citations (TC: 483). Karen M. Hennes (TC: 478) ranks in the tenth position in CFO-related research.

Table 4. Most prolific authors as per the productivity metric.

Author	Author's Affiliation	h-Index	g-Index	Total Citations	Total Publications
Campbell R. Harvey	Duke University	6	6	1619	6
John R. Graham	Fuqua School of Business, Duke University	5	7	1598	7
Murillo Campello	Cornell University	1	1	906	1
Yiwei Li	Essex Business School, University of Essex, UK	6	6	631	6
Shivaram Rajgopal	Columbia Business School	4	4	550	4

Table 4. Cont.

Author	Author's Affiliation	h-Index	g-Index	Total Citations	Total Publications
Jeong-Bon Kim	Department of Accountancy, City University of Hong	2	2	530	2
Liandong Zhang	Department of Accountancy, City University of Hong	1	1	496	1
Geoffrey R. Frost	University of Newcastle, Newcastle, Australia	2	2	483	2
Trevor D. Wilmshurst	Victoria University of Technology, Melbourne, Australia	2	2	483	2
Karen M. Hennes	University of Oklahoma	1	1	478	1

Source: researcher's own elaboration.

Top Publishing Country as Per Corresponding Authors

An examination of the publications' worldwide distribution reveals that they are spread throughout 48 nations, with most of them concentrated in the United States, China, Australia, the United Kingdom, Canada, and Malaysia, among other nations (Figure 2). The leading contributor in the field of CFO research is the US with 140 articles, followed by China with 39 articles. The United Kingdom (31 articles) is preceded by Australia (32 articles) but only by one article. Hong and India have produced almost the same number of articles, i.e., nine each. This shows that most research has been conducted in developed countries, providing room for the same research to be carried out in developing nations.

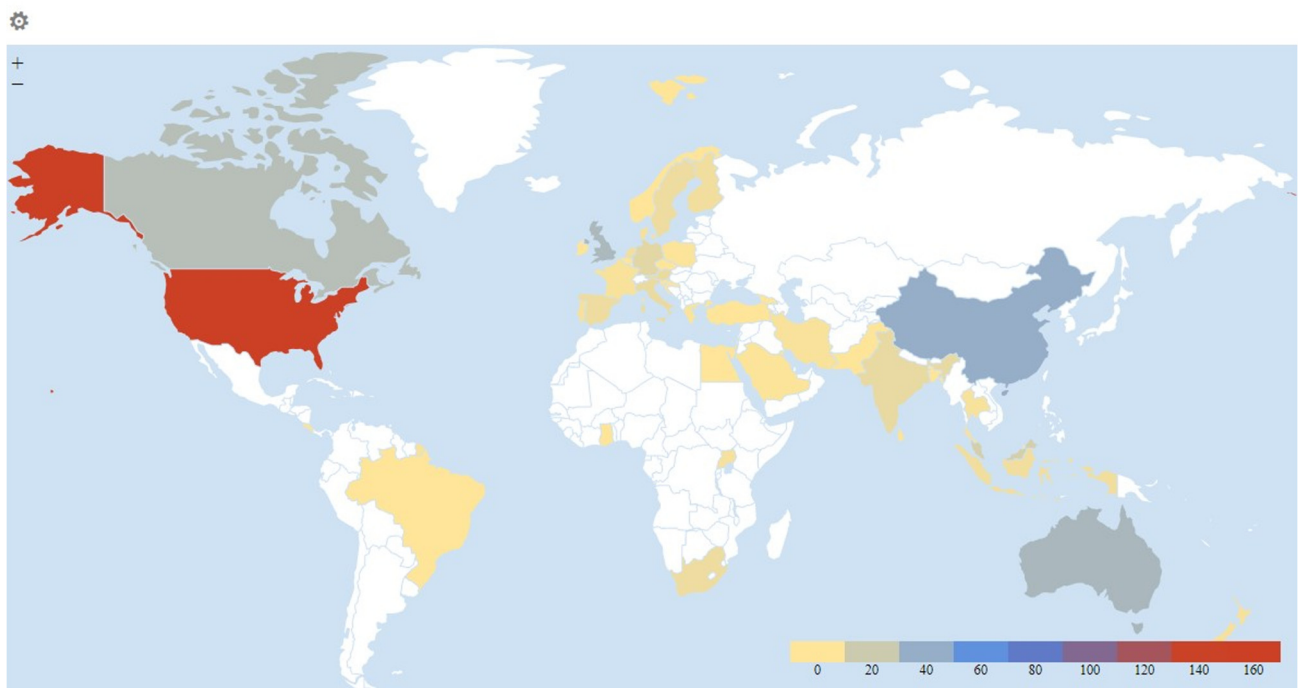


Figure 2. Country-wise publications using heatmap.

Top Countries as Per Total Citations

After a detailed examination of the data corpus, it is evident (see Table 5) that the USA is in the lead with 6017 citations, and the United Kingdom takes the second lead with 676 total citations, followed by Australia (TC: 574) in terms of the number of citations. While the performance of Canada, China, and Germany in this matter is notable, the performance of Singapore, Finland, Spain, and Malaysia is also impressive as per total citations.

Table 5. Most prolific countries.

Country	TC	Average Article Citations
USA	6017	42.98
United Kingdom	676	21.81
Australia	574	17.94
Canada	529	19.59
China	381	9.77
Germany	282	25.64
Singapore	281	281.00
Finland	271	45.17
Spain	255	36.43
Malaysia	181	11.31

Source: researcher's own elaboration.

4.2. Science Mapping

4.2.1. Temporal Analysis Using Word Clouds

A temporal analysis enables us to determine the beginning of a new phenomenon and its progression into an emerging or trending topic. The corpus of research articles on CFO was divided into four time spans: 1990 to 1999, 2000 to 2009, 2010 to 2019, and 2020 to 2022. We followed Kumar et al. (2022a) to divide the period into four slices, which enabled us to understand the temporality and stretch of the evolution of the field. The key topics in each time period were unearthed through a temporal analysis exemplified by the word clouds (Kumar et al. 2022a) in Figures 3–6.



Figure 3. CFO research between 1982 and 1999 using word cloud from the *Bibliometrix-R* software.

Figure 3 illuminates the dawn of topics such as financial management, United States, organisation and management, administrative personnel, article, industry, and hospital in the initial years of CFO research between 1990 and 1999. Aspects such as persuasive communication, economics, decision-making, planning techniques, personnel management, questionnaire, and leadership, as well as some aspects of hospitals like hospital management, hospital planning, hospital finance, community hospital, and health facility administrators, were also explored in this period of study. In contrast, research on economics, investment, methodology, job description, budget community, normal humans, and Michigan received less attention.

Figure 4 illustrates the continued growth of administrative personnel and United States research by discovering fresh territory of financial management, organisational, organisation and management, decision-making, finance economics, and investment. Additionally, the field rapidly expanded in this decade to address public relations, governing

boards, boards of trustees, problem-solving, standards, planning techniques, and the chief financial officer. The decade also discussed customer satisfaction, consumer participation, and industrial relations. Other key topics of this decade were industrial management, environmental management, financial games, business, Australia, and employee performance appraisal. The gradual growth of IT, like computer systems, computer programs, and information systems, also occurred in this decade.



Figure 4. CFO research between 1992 and 2001 using word cloud from the *Bibliometrix-R* software.



Figure 5. CFO research between 2002 and 2011 using word cloud from *Bibliometrix-R* software.



Figure 6. CFO research between 2012 and 2022 using word cloud from *Bibliometrix*-R software.

Further, Figure 5 exhibits the continued growth of chief financial officer, chief executive officer, marketing, capital, sales, commerce, debt, costs, and leadership between 2002 and 2011, including the notable increase in studies that started in the prior decade related to decision-making, United States, administrative personnel, economics, customer satisfaction, article, and leadership. There was also increasing research on capital flow, budget control, batch industry, CEO credibility and certification, abnormal returns, chemical industry, cash flow, and cash management.

Finally, Figure 6 depicts the advent of chief financial officers, chief executive officers, financial reporting through surveys with the proper financial system, human resource management through leadership and group practice, and environmental management to ensure sustainable development between 2020 and 2022, including the notable explosion of qualitative research and operations research. There was also an increase in research on male and female employment, top management teams, capital market, and earnings management through adequate design/methodology/approach, including the remarkable explosion of research that had begun in the earlier decades concerning investments, commerce, economics, finance, articles, and sales through exploration of novel research fields that included Bayesian approaches and networks, banking, asymmetry, academic research, barriers, and accounting practices. There was also continuous research on managers in Washington.

4.2.2. Bibliographic Coupling (RQ2)

Figure 7 illustrates the bibliographic coupling in our dataset. Bibliographic coupling is based on the idea that two publications with a high degree of reference similarity will also have content similarities (Hoffman and Holbrook 1993; Donthu et al. 2021b). The size of the nodes in a map produced by bibliographic coupling indicates the overall strength of the links between the articles. The relationship between bibliographic nodes demonstrates the separation or proximity of the articles in the network.

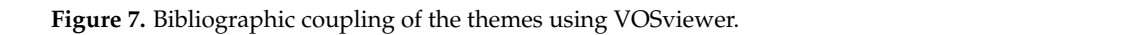


Table 6. Bibliographic information using VOSviewer.

Authors	Publication Title

Clusters	Publication Title	Author	TC	TLS
Cluster 1: CFO and	An empirical analysis of the levers of control framework	Widener (2007)	430	37
Financial	Corporate environmental reporting	Wilmshurst and Frost (2000)	417	8
performance	Stock market reaction to CEO certification: the signaling role of CEO background	Zhang and Wiersema (2009)	230	108
	CIO reporting structure, strategic positioning, and firm performance	Banker et al. (2011)	193	23
	Factors influencing organizational knowledge transfer: Implication for corporate performance	Rhodes et al. (2008)	135	6
	An institutional perspective on the changes in management accountants' professional role	Goretzki et al. (2013)	131	17
	Organisational benefits and implementation challenges of mandatory integrated reporting	Steyn (2014)	108	1
	How CFOs determine management accounting innovation: An examination of direct and indirect effects	Naranjo-Gil et al. (2009)	102	93

Table 6. Cont.

Clusters	Publication Title	Author	TC	TLS
	Upper-echelon executive human capital and compensation: Generalist vs. specialist skills	Datta and Iskandar-Datta (2014)	86	81
	The effects of judgments of new clients' integrity upon risk judgments, audit evidence, and fees	Beaulieu (2001)	86	9
	Earnings quality: Evidence from the field	Dichev et al. (2012)	416	238
	CFOs and CEOs: Who have the most influence on earnings management?	Jiang et al. (2010)	323	139
	Detecting deceptive discussions in conference calls	Larcker and Zakolyukina (2012)	267	94
	Does hiring a new CFO change things? An investigation of changes in discretionary accruals	Geiger and North (2006)	229	103
Cluster 2: CFO and manipulation in reporting	CFO gender and accruals quality	Barua et al. (2010)	210	123
	Gender differences in financial reporting decision making: Evidence from accounting conservatism	Francis et al. (2015)	208	267
	Performance measurement of corporate tax departments	Robinson et al. (2010)	167	10
	Female executives and earnings management	Peni and Vähämaa (2010)	162	104
	Executives' "off-the-job" behavior, corporate culture, and financial reporting risk	Davidson et al. (2015)	122	175
	CFO narcissism and financial reporting quality	Ham et al. (2017)	111	183
	CFOs versus CEOs: Equity incentives and crashes	Kim et al. (2011)	496	145
	The real effects of financial constraints: Evidence from a financial crisis	Campello et al. (2010)	906	8
	Initial public offerings: CFO perceptions/Initial public offerings: An analysis of theory and practice	Brau and Fawcett (2006)	375	10
	What drives corporate liquidity? An international survey of cash holdings and lines of credit☆	Lins et al. (2010)	252	41
Cluster 3: CFO and financial decisions	CEOs versus CFOs: Incentives and corporate policies	Chava and Purnanandam (2010)	251	55
	Capital allocation and delegation of decision-making authority within firms	Graham et al. (2015)	144	68
	Value destruction and financial reporting decisions	Graham et al. (2006)	87	17
	The chief financial officer's perspective on auditor-client negotiations*	Gibbins et al. (2007)	81	55
	Managerial risk taking incentives and corporate pension policy	Anantharaman and Lee (2014)	77	122
	The impact of CFO gender on bank loan contracting	Francis et al. (2013)	71	72

Table 6. Cont.

Clusters	Publication Title	Author	TC	TLS
Cluster 4: CFO and earning management	The importance of distinguishing errors from irregularities in restatement research: The case of restatements and CEO/CFO turnover	Hennes et al. (2008)	478	114
	Why do CFOs become involved in material accounting manipulations?	Feng et al. (2011)	281	147
	The financial expertise of CFOs and accounting restatements	Aier et al. (2005)	204	41
	Financial executive qualifications, financial executive turnover, and adverse SOX 404 opinions	Li et al. (2010)	175	100
	On the choice and replacement of chief financial officers	Mian (2001)	161	22
	Earnings restatements, the Sarbanes-Oxley Act, and the disciplining of chief financial officers	Collins et al. (2009)	78	86
	CFO fiduciary responsibilities and annual bonus incentives	Indjejikian and Matějka (2009)	76	112
	Internal control material weaknesses and CFO compensation*	Hoitash et al. (2012)	70	205
	Financial restatements, audit fees, and the moderating effect of CFO turnover	Feldmann et al. (2009)	67	128
	Chief financial officers as inside directors	Bedard et al. (2014)	62	284
Cluster 5: CFO and audit management CFO	Enterprise risk management: An empirical analysis of factors associated with the extent of implementation	Beasley et al. (2005)	347	1
	Corporate governance in the post-Sarbanes-Oxley era: Auditors' experiences*	Cohen et al. (2010)	251	65
	Who's really in charge? Audit committee versus CFO power and audit fees	Beck and Mauldin (2014)	104	131
	Auditor–client management relationships and roles in negotiating financial reporting	McCracken et al. (2008)	95	14
	The association between characteristics of audit committee accounting experts, audit committee chairs, and financial reporting timeliness	Abernathy et al. (2014)	89	116
	A critical analysis of the independence of the internal audit function: evidence from Australia	Christopher et al. (2009)	88	30
	A comparison of internal audit in the private and public sectors	Goodwin (2004)	57	3
	Does audit committee accounting expertise help to promote audit quality? Evidence from auditor reporting of internal control weaknesses	Lisic et al. (2019)	43	106
	The role of the audit committee in resolving auditor-client disagreements: A Malaysian study	Salleh and Stewart (2012)	41	34

Table 6. Cont.

Clusters	Publication Title	Author	TC	TLS
Cluster 6: CFO's compensation and reporting quality	A study of corporate disclosure practice and effectiveness in Hong Kong	Ho and Wong (2001)	80	3
	Influence activities and favoritism in subjective performance evaluation: Evidence from Chinese state-owned enterprises	Du et al. (2012)	78	4
	Manager-specific effects on earnings guidance: An analysis of top executive turnovers	Brochet et al. (2011)	50	67
	Are CEOs and CFOs rewarded for disclosure quality?	Hui and Matsunaga (2015)	46	75

TC: total citation; TLS: total link strength. Source: researcher's own elaboration.

Cluster 1: CFO and Financial Performance (Red)

The first cluster contemplates CFO and financial performance. Widener's (2007) article has received the highest citations (TC: 430) in the cluster, with a total strength link of 37. He explored the control system antecedents that connect uncertainty and strategic risk to control systems, which are thought to impact learning, focus, and, ultimately, company performance. He found that uncertainty and strategic risk are the primary motivators for the diagnostic and interactive roles performance metrics play. This understanding is in line with Zhang and Wiersema's (2009) study, which employed market signalling theory to look into the factors investors consider when determining a company's value. This conclusion echoed Banker et al.'s (2011) findings that discussed how the reporting structure and strategic positioning of the chief information officer (CIO) affect firm performance. They concluded that while the CEO–CIO reporting structure might not be the optimal strategy for all businesses, the alignment of CIO reporting of the firm with strategic positioning favours business performance.

Similarly, Rhodes et al. (2008) discussed a holistic approach incorporating knowledge sharing, innovation, and firm performance. To investigate if there was a correlation between how certain important factors were rated and how often they were reported, an analysis was conducted by Wilmshurst and Frost (2000). Additionally, Naranjo-Gil et al. (2009) claimed that firms can ensure performance by adopting innovative accounting measures like enterprise resource planning (ERP), balanced scorecards, benchmarking, etc.

Cluster 2: CFO and Manipulation in Reporting (Yellow)

The paper entitled "Earnings quality: Evidence from the field" by Dichev et al. (2012) received the most citations (TC: 416), making it the most eminent article in this cluster. They offered insights regarding earnings quality based on a survey of CFOs of publicly traded firms. They demonstrated that CFOs' perceptions of profit quality differ from current research, emphasising how decisions are made as a criterion for measuring earnings quality. Similarly, (Xuefeng) Jiang et al.'s (2010) study evaluated how CFO equity incentives affect earning management. They discovered that accruals and the likelihood of exceeding analyst estimates are more sensitive to the CFO's equity incentives than the CEO's. Classifier models based on language analysis of misleading statements made on quarterly earnings calls were estimated by Larcker and Zakolyukina (2012). They discovered that deceptive executives use less shareholder value, less non-extreme positive feelings, and more broad knowledge. Notably, Peni and Vähämaa (2010) examined how the gender of a company's top executives correlates with earnings management. The data confirmed that organisations run by female CFOs are more prone to adopt earnings-reducing discretionary accruals. The survey also found that organisations run by female CFOs take a more conservative approach to controlling their bottom line. These results also corroborate the findings of Francis et al. (2014), who presented evidence of differences in gender in accounting

decision-making by analysing whether there are consistent differences in the selection of accounting conservatism between male and female CFOs. Furthermore, the relationship between financial reporting risk and executives' behaviour outside of work, as indicated by their possession of expensive goods (low "frugality") and prior legal violations, was investigated by Davidson et al. (2015). In this cluster, considerable research has shed light on the adjustments to discretionary accruals (Geiger and North 2006), accrual quality and CFO gender (Barua et al. 2010), and quality of financial reporting and CFO narcissism (Ham et al. 2017).

Cluster 3: CFO and Financial Decisions (Blue)

The third cluster delineates the CFO's involvement in financial decision-making. Kim et al.'s (2011) article has received the highest citation (TC: 496) with a total link strength of 145 in the cluster. They showed that a firm's future risk of a stock price crash is significantly and positively related to the sensitivity of a CFO option portfolio value to stock price. In their paper, Campello et al. (2010) surveyed CFOs to determine whether their companies were experiencing credit constraints due to the 2008 financial crisis. The results revealed that enterprises with financial restraints significantly intended to reduce R&D spending, staffing, and capital expenditures. A noteworthy study by Brau and Fawcett (2006) intended to evaluate how motivation, timing, underwriter choice, underpricing, signalling, and choosing to remain private in an IPO correspond to theoretical expectations. They found that acquisitions are the main reason for going public. In addition, a comprehensive analysis of how risk-taking incentives for managers influence the financial policies of businesses was conducted by Chava and Purnanandam (Davidson et al. 2015). The results revealed that CEOs' and CFOs' personal risk preferences substantially impact the financial decisions made by their respective companies. These findings corroborate with Graham et al. (Davidson et al. 2015), who conducted a global survey of CFOs to learn how much authority leaders give others to make financial decisions and what factors influence this authority. In this cluster, considerable research has shed light on the decisions made by the CFO regarding performance evaluation and voluntary disclosure (Graham et al. 2006), the CFO's opinion on the auditor and client negotiations over clients' financial statements (Gibbins et al. 2007), investment in risk-taking and company pension plans (Anantharaman and Lee 2014), and bank loan contracting and CFO gender (Francis et al. 2013).

Cluster 4: CFO and Earning Management (Green)

The second cluster condenses the CFO and manipulation in reporting. Hennes et al.'s (2008) article about the intentional misreporting of CFO on restatement data has received the highest citations (TC: 471) in the cluster with a total strength link of 302. They demonstrated that only one lawsuit followed the set of restatements labelled as errors, compared to numerous fraud-related class action cases in most restatements defined as irregularities. Feng et al. (2011) looked into what led to the CFO becoming complicit in a major accounting fraud scheme. They discovered that while CFOs who engage in accounting fraud incur significant legal fees, they still enjoy comparable equity incentives to those of matched non-fraudulent firms' CFOs.

This notion is supported by the findings of Aier et al. (2005), who explored whether the qualities of chief financial officers (CFOs) are related to accounting errors (using accounting restatements as a proxy). Their findings are consistent with the view that restatements poorly reflect the CFO's competence in financial matters. Collins et al. (Feng et al. 2011) examined the labour market penalties meted out to former CFOs of restatement firms, the involuntary departure of CFOs following earnings restatements, and whether these disciplinary actions have become more severe since the Sarbanes–Oxley Act (SOX) of 2002 was passed. This finding corroborates with Li et al. (2010), who found that the mere appointment of a new CFO does not improve SOX 404 opinion; a more capable CFO must be hired to enhance opinions. Similarly, in their paper, Indjejikian and Matějka (2009) offered a paradigm that views chief financial officer bonuses as compensation for balancing

executive decision-making with fiduciary oversight of financial reporting. The articles in this cluster advocate for using low-cost, easily measurable, and attributable performance indicators in board and remuneration committee evaluations of CFOs (Hoitash et al. 2012) and note that the increased audit costs are a result of a decline in an organisation's credibility as well as an increase in the perceived risk of an audit (Feldmann et al. 2009).

Cluster 5: CFO and Audit Management (Sky Blue)

The sixth cluster contemplates the CFO and audit management. Beasley et al.'s (2005) article, which encapsulated the management of risk in an enterprise and found the positive relation of enterprise risk management (ERM) with the presence of a Big Four auditor, CFO, CEO, the size of the organisation, and businesses, has received the highest citation in the cluster (TC: 347). The articles in this cluster underscore the auditor's interaction effect on other stakeholders (Cohen et al. 2010). In contrast, the audit committee and CFO mainly affect fees when their foil is less powerful, as Beck and Mauldin (2014) claimed. In their article, Abernathy et al. (2014) investigated the relationship between the financial expertise of audit committee (AC) members and the timeliness of financial reporting. He then expanded the topic by looking into how the source of accounting expertise (such as public accounting or the CFO) differentially influences financial reporting timeliness. Notably, two principal types of relationships (proactive and reactive) between CFOs and audit partners (McCracken et al. 2008), comparison between public and private internal audits (Goodwin 2004), and the promotion of accounting expertise of the audit committee (Lisic et al. 2019) were important topics of discussion. Christopher et al. (2009) examined the internal audit function's independence through its interactions with management and the audit committee. This finding is similar to the results of Salleh and Stewart (2012), who discovered that the audit committee serves as a third-party mediator who aids in the dispute's resolution.

Cluster 6: CFO's Compensation and Reporting Quality (Purple)

The final cluster contemplates the compensation of the CFO and the reporting quality. The article entitled "A study of corporate disclosure practice and effectiveness in Hong Kong" by Ho and Wong (2001) has received the most citations in the cluster (TC: 80) with 3 TLS. The article explored how CFOs and analysts see different challenges relating to data sharing, disclosure, and capital market efficiency. They found that analysts perceived a greater demand for increasing financial reporting rules than CFOs. Similarly, considerable research by Hui and Matsunaga (2015) found that the annual compensation modifications for the CEO and CFO are favourably correlated with improvements in disclosure quality. In addition, the role the two-way street of favouritism and influence plays in subjective performance evaluation when both subordinates and superiors participate was explored by Du et al. (2012). He argued that subjective methods of evaluating employee performance could significantly impact workplace behaviours. Brochet et al.'s (2011) article encapsulates the participation of CFOs and CEOs in the affairs of businesses. He concluded that temporary guidance breaks following CFO changes are caused by the incoming CFO's lack of industry- and firm-specific forecasting.

5. Discussion

5.1. Managerial and Industrial Implications

Any company's growth trajectory is greatly influenced by the TMT (top management team) (Boeker 1997). Hence, our findings propound numerous insights for practitioners and policymakers. Our results bring a platter of new insights to practitioners and policymakers. First, the positioning structure of the CFO–CIO is crucial for any firm in the decision-making process. Managers must structure the CFO role effectively to fit with the company's strategic orientation to augment the firm's performance (Banker et al. 2011).

Further, CFOs are accountable for matters relating to accounting and finance. This notion proves that CFOs are more active in generating visionary ideas for value generation

at the strategic level. Therefore, research on CFO should receive more attention at the firm level (Burkert and Lueg 2013).

Second, the findings from the corpus identified that CFO qualifications, calibre, and skills are the key determinants of firm value and internal control quality. Noteworthy studies from the corpus use internal control quality, a novel non-financial yet significant criterion, to analyse CFO turnover (Li et al. 2010). This takeaway suggests that a company's shortcomings can be managed in many ways, depending on the qualifications of the chief financial officer (CFO) and their approach to strategic decision-making.

Third, our review identifies the leading issues and recent findings regarding innovation in accounting and finance in the field of CFO research as it relates to the business-related area. The findings suggest that adopting innovation in the accounting system (management accounting system) would help CFOs update their skills and highlight the need for change in the business administration of a firm (Naranjo-Gil et al. 2009). In addition, business managers should view the process of realising ERP benefits as a continuous cycle following ERP adoption (Esteves 2009). This may contribute to a better comprehension of success and satisfaction levels of ERP among stakeholders, both expected and perceived.

Fourth, our findings imply that boards should exercise extra prudence when compensating their CFOs with equity incentives, especially stock options (Kim et al. 2011). Furthermore, modifying CFO compensation packages is not always the best solution. Enhancing CFO independence by reducing CEO pressure on the CFO may be crucial to raising the calibre of financial reporting. This can be accomplished if audit committees become more involved in reviewing CFO performance and making hiring and retention choices (Feng et al. 2011).

Finally, the bibliographic coupling results portrayed that accounting conservatism is strongly influenced by the top executives' gender (Francis et al. 2015). As more and more businesses include women in their top management teams, it is crucial to thoroughly grasp the possible gains, risks, and costs of having female chief financial officers (Francis et al. 2014). In addition, the performance of companies, which is a significant element in determining the cost of capital, may be impacted by the gender of CFOs and discount rates. The gender of the CFO matters greatly when making choices about the capital structure (Francis et al. 2013).

5.2. Directions for Future Research (RQ4)

Using the theory, context, characteristics, and methodology (TCCM) framework, we identified prospective future study subjects (Paul and Rosado-Serrano 2019; Srivastava et al. 2020; Zhang et al. 2021b).

5.2.1. Theory

A myriad of empirical research from our corpus has applied the following critical theories: upper echelons theory, strategy–structure theory, agency theory, stewardship theory, resource-based view theory, resource dependency theory, institutional theory, attempted control theory, the alignment–fit paradigm, human capital theory, the emotions theory of deception, graph theory, contract theory, and double standard competence theory. In the case of CFO research, the theory of upper echelons has been used to highlight how a firm's strategic positioning (cost leadership or differentiation) should be a critical factor in determining its CIO reporting structure and eventually improve firm performance (Banker et al. 2011). The CFO's compensation should be dependent on their specialised or general skills (Datta and Iskandar-Datta 2014). Switzer and Wang (2013) formulated their hypothesis based on agency theory and argued that a large board would reduce the possibility of default. Chadwick and Dawson (2018) extended the agency and stewardship theory (Pieper 2010) by combining gender diversity and social psychology ideas (double standard theory) (Foschi 1996) with a mainstream, theoretical management lens (upper echelons theory) (Hambrick and Mason 1984). There have not been many formal attempts to link experimental economics and decision theory (Hennessy and Chemla 2022). An essential

expansion of discretion theory is the treatment of governance mechanisms as contingency effects, such as institutional owners and securities analysts. This should reactivate scholarship on management discretion sources to create fresh research opportunities (Gupta et al. 2020). Expanding the well-known theories can be a viable strategy for developing the field of CFO research. Future studies can be carried out to evaluate theoretical explanations for both a cost leadership approach and a differentiation approach with a CIO–CFO reporting structure (Banker et al. 2011). Future research will be needed to determine how effectively auditors can distinguish between audit committees that are merely symbolic and perform the ritual-based role suggested by the institutional theory (i.e., “in the form”) and audit committees that take a more activist role in overseeing the financial statement reporting process as suggested by an agency theory approach (i.e., “in substance”) (Cohen et al. 2010). These traditional theories could be extended by employing or incorporating additional procedures in upcoming studies. As a result, this review suggests exploring conventional theories through various approaches and extending traditional theories to different finance contexts.

5.2.2. Contexts

From the dataset, we insinuate that future research should include emerging countries, cross-country analysis, other C-level executives, and research accentuating small firms. First, institutional contexts fluctuate significantly among countries and regions depending on their level of development. Therefore, different countries’ contexts may affect the peripheries of CFO research. Results from our corpus show that most research is conducted in developed countries, primarily the US, Canada, the UK, and Australia, yielding the scope of future research in emerging countries. For example, Liu et al. (2016) investigated the impact of the gender of the chief financial officer (CFO) on earnings management in Chinese listed corporations. Gupta et al. (2020) developed a theory on how the gender of CFOs affects financial reporting to produce crucial insights. We propose that future researchers can gather information from developing economies or use a variety of data sources to understand the theoretical confines of CFO research. Second, cross-country analysis may unwrap potential insights for CFO research (Hiebl 2015; Goretzki et al. 2013). For example, Cohen et al. (2010) explored corporate governance based on the auditor’s experience after the Sarbanes–Oxley Act. Future research may examine how different countries’ legal systems impact the functions of audit committees. In addition, further research should be carried out to determine if the CFO’s traits and presence vary among nations, as it does with the CEO (Caselli and Di Giuli 2010). A cross-country analysis including subsamples from various time periods could shed light on the policies of a financial product of small financing firms globally and the effects of alterations in societal norms, political ideologies, and economic conditions, among other things (Di Giuli et al. 2011).

Third, the role of other C-level executives in decision-making is possibly a crucial point to consider in any firm. For example, Banker et al. (2011) emphasised the CFO–CIO reporting structure. Future studies could define the appropriate reporting structure for other burgeoning C-level executives, like chief marketing, chief sustainability, chief operation, and creative officers. Further, the advantages and disadvantages of technical and generalist abilities in other C-suite jobs represent a fascinating area for further investigation (Datta and Iskandar-Datta 2014). Fourth, there is a dearth of small business-related articles, even though they were included in our corpus. Due to data limitations, Francis et al. (2013) exclusively focused on sizable loans given to publicly traded corporations. In such loan decisions, the discriminating effect might be less pronounced. This warrants the need to extend the findings to personal loans and small company loans. Moreover, the view of the availability of financial products from banks by SFFs (small family firms) may be the subject of future investigations (Di Giuli et al. 2011). In addition to the above contexts, future studies should examine the gender dynamics in various situations and other periods to determine whether the findings are generalisable across organisational kinds, cultural backgrounds, and epochs (Chadwick and Dawson 2018).

5.2.3. Characteristics

Next, we outline potential avenues for future research on the characteristics of CFO research. The investigation of the study constructs' antecedents and consequences might guarantee a thorough comprehension of CFO research.

Antecedents: From the antecedent perspective of CFO research, Banker et al. (2011) formulated hypotheses that supported the link between an organisation's strategic orientation and structure of CIO reporting, as well as the benefit of their alignment for firm performance. Other factors like the CIO's background, compensation, education, prior employment, and abilities that influence the CIO–CFO reporting structure could also be used to forecast the CIO reporting structure. The impact of variables like the type of ERP implemented, ERP modules, technical difficulties, and organisational structure could also be used for future research (Esteves 2009; Naranjo-Gil et al. 2009). In addition, to provide in-depth empirical and theoretical insights, researchers may examine the function and influence of CA (Controller Akademie) and ICV (Internationaler Controller Verein) on organisations and other actors of the firm (Goretzki et al. 2013).

Moreover, the factors influencing outside CFO succession (Mian 2001), the value of specialised versus generalist talents that vary by industry type (Datta and Iskandar-Datta 2014), and the influence of female CFO on firm value (Francis et al. 2014) provide room for future research. When analysing the relationship between incentives of managerial equity and the probability of a stock price crash (Kim et al. 2011), it is suggested that various aspects of options and stock be incorporated, as well as the multiple traits of CFOs and CEOs that might be useful for future analytical studies. Furthermore, the executive's level of narcissism should be measured directly in future research rather than adopting the signature size as a proxy of personality traits to study CFO narcissism (Ham et al. 2015).

Outcomes: The analysis of our corpus highlights various avenues for future CFO-related research. Through our review, firm performance emerges as a potential outcome of CFO research. Researchers in upcoming studies may investigate the impact of female CFOs on firm performance (Francis et al. 2013) and the post-CFO changeover time frame to evaluate business restructuring and related performance changes (Mian 2001) as well as various perspectives on earning quality under different settings (Dichev et al. 2012). In addition, to examine the employment of departing CFOs when they leave their current position (Li et al. 2010), determining how equity incentives affect other lower-level managers (Jiang et al. 2010) might be a potential future research avenue. Research on the investigation of how CFO behavioural characteristics, such as overconfidence, affect corporate cash policies (Florackis and Sainani 2018) and the effectiveness of ERM in protecting or promoting shareholder value (Beasley et al. 2005) may provide room for future research. Further, we suggest concentrating on both the availability of private debt financing and interest rates to investigate gender discrimination (especially for women) in the credit market (Francis et al. 2013).

Influencers: Some variables or factors may influence the study constructs, such as mediating or moderating effects. Previous studies on CFO delineate a paucity of moderating variables and mediating variables. Hence, we propose prospects for future research. The interacting variables, i.e., moderating variables such as risks in the research, should be incorporated to investigate the interaction effect of the model (Beasley et al. 2005). It is not sufficient to assume that institutional owners and analysts of securities have a moderating effect on other governance mechanisms, such as the media and employees; instead, this influence needs to be theoretically developed and practically investigated (Gupta et al. 2020). Furthermore, future studies may be fruitful in examining how other stakeholders' influence shapes the impact of top executives on financial misreporting. Therefore, researchers should incorporate moderating, mediating, or instrumental variables to understand how they affect CFO research in future studies.

5.2.4. Methods

According to our review, researchers use quantitative methodological approaches more frequently than qualitative ones. Additionally, there is a propensity only to employ one methodology, be it qualitative or quantitative. The use of mixed methods is uncommon in CFO studies. It would be more desirable to adopt a mixed-method approach rather than a single method, as a complete grasp of CFO research could be accomplished by merging individual subjectivity (inductive study using qualitative methods), broader social structure (deductive studies through large-scale surveys and experimental or archival studies) (Cohen et al. 2010; Naranjo-Gil et al. 2009), and potential curvilinear links (Chadwick and Dawson 2018). Under the quantitative approach, most studies incorporate the survey method, providing expansive room for future research to use other statistical modelling techniques like SEM or path analysis (Li et al. 2010). The results of our dataset highlight the need to employ qualitative methods for upcoming studies. Complementary approaches may include field studies, in-depth interviews, and natural language processing techniques (Beasley et al. 2005; Larcker and Zakolyukina 2012; Datta and Iskandar-Datta 2014).

Existing studies have not investigated CFO research at various time intervals. Consequently, a longitudinal method, such as ethnographic in-depth longitudinal research, could be utilised as an alternative strategy to explore CFO research (Goretzki et al. 2013; Chadwick and Dawson 2018). Also, future CFO research should embrace review studies and numerous case study methods to enhance the accuracy of the findings. Figure 8 presents an inclusive summary of future research direction according to TCCM.

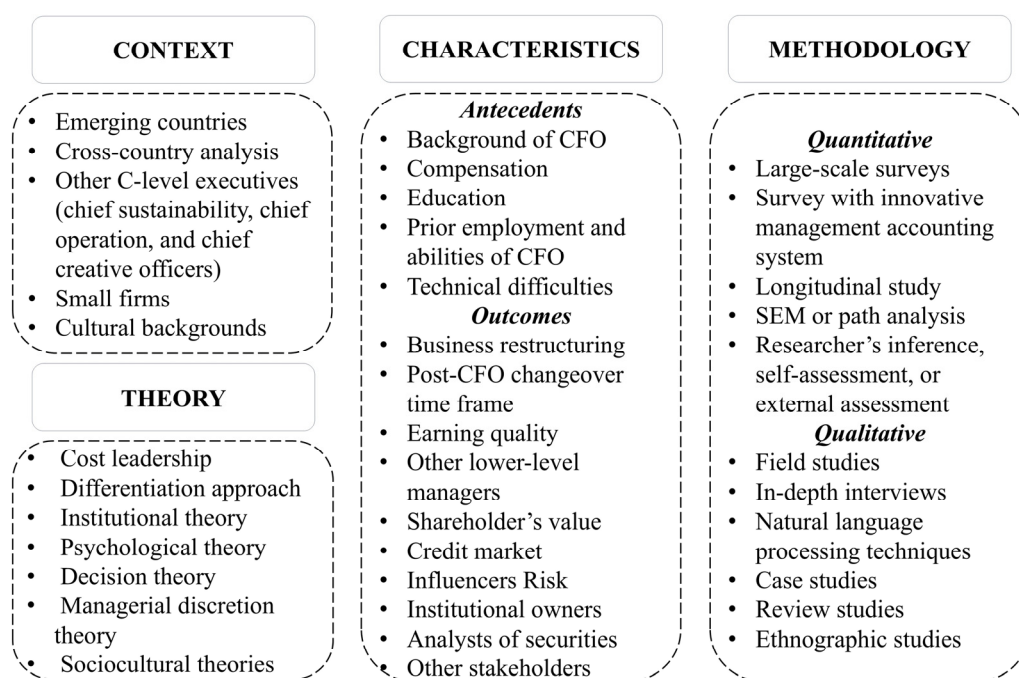


Figure 8. Future research directions. Source: researcher's own elaboration.

6. Conclusions and Limitations

In this section, we provide contributions and limitations of the current review. On a day-to-day basis, CFOs oversee a company's accounting and finance departments and have the most significant direct control over all financial and accounting decisions. Due to their roles and areas of expertise, they have access to the most up-to-date information and projections about a firm's financial obligations, prospective investment opportunities, cash flows, etc. (Liu et al. 2021). However, little research has sought to investigate CFO-related research at the individual level. In response, we suggest some areas where future study may be fruitful in the development of a more comprehensive understanding of CFO-related research.

First, we provided a concise synthesis of CFO research. We then conducted quantitative analysis, i.e., bibliometric analysis. Under this, we performed performance analysis (information about top contributors) and science mapping (bibliographic coupling and temporal analysis). We strove to comprehend the prevailing knowledge structure and proposed directions for future research according to the TCCM framework (Paul et al. 2021).

One limitation of CFO research is that most academics have attempted to apply key results of how CFOs may affect organisational performance and reporting quality by relying on current literature primarily focused on CEOs (Habib and Hossain 2013; Yu 2023). While this research has provided new opportunities for academics, they do not have enough detail on the quirks unique to the CFO position.

Second, because our corpus relies on bibliographic coupling analysis, certain clusters may only contain a small number of papers (as reflected in the CFO's compensation and reporting quality).

Third, despite the ground-breaking ideas presented here, this review's diversity of bibliometric findings is still restricted. Hence, future studies can expand on the themes generated in the present review, incorporating other bibliometric analytical techniques, such as keyword co-occurrence analysis with bibliographic coupling, to triangulate the results (Donthu et al. 2021a; Sharma et al. 2022).

Fourth, our corpus only included articles from Scopus. Although extensive, this database is not complete. Undoubtedly, we anticipate that some crucial documents may have slipped our attention. Further studies should encompass these studies.

Fifth, although the literature synthesis of CFO research was crafted using quantitative techniques and bibliographic coupling, the clustering results and their interpretation included some qualitative judgements that showed subjectivity (Pinho et al. 2022). In addition, books, reviews, conference proceedings, and reports were not considered in the analysis to ensure the sample's homogeneity; the chosen articles were all categorised explicitly as "business, management, and accounting" and "economics, econometrics, and finance. Therefore, it would be fascinating to evaluate other articles that might not have been in the sample to supplement the findings from this study.

Lastly, we relied specifically on the keywords "Chief Financ* Offic*" or "CFO". In addition to this, using other pertinent keywords could result in a variety of papers being obtained, such as those relating to chief operating officers, chief sustainability officers, etc. Moreover, several visualisation tools like Pajek could be used to thoroughly understand the scientific research field.

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Article

Insider Trading and CEO Pay-Gap Induced Turnover

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Abstract: We explore how insider trading returns, disparities in executive pay, and CEO turnover are interrelated. Our findings reveal both independent and interactive effects for insider trading returns, the CEO pay gap, and the likelihood of CEO turnover. First, an increase in abnormal returns from insider purchases lowers the probability of a CEO's turnover, while an increase in abnormal returns from insider sales increases the likelihood of a CEO's dismissal. Second, the CEO pay gap negatively affects the probability of CEO turnover for insider purchases, but it does not have a similar effect on insider sales. Third, the interaction between insider abnormal returns and any CEO pay disparity influences the impact of these returns on CEO turnover. Specifically, this interaction diminishes the positive effect of insider selling on the probability of a CEO's dismissal, offsets the negative effect of insider purchasing on CEO dismissal, and, finally, amplifies the negative impact of CEO pay disparity on the probability of a CEO's dismissal during periods witnessing insider purchases.

Keywords: insider abnormal returns; CEO pay-gap induced turnover; CEO entrenchment

JEL Classification: G14; G30; G41

1. Introduction

Setting relative pay gaps between the CEO and other senior executives in top management teams is one of the crucial decisions undertaken by firm boards. Executive pay disparity, sometimes referred to as the CEO pay gap or CEO pay slice, represents the share of total remuneration allocated to the CEO compared to other executives on the board. This disparity can significantly influence firm outcomes, particularly the likelihood of CEO turnover, while also impacting the behavior of non-CEO executives. For instance, it may incite them to leverage corporate insider information, thus amplifying or mitigating the chances of CEO turnover (Conyon et al. 2011; Frydman and Jenter 2010; Edmans et al. 2017).

Recent studies suggest two main theoretical perspectives to explain the effects of CEO pay disparity on turnover. Firstly, under the managerial power theory, a large CEO pay slice reflects a CEO's capacity to entrench themselves within a firm by exerting significant control over the pay-setting process, thereby insulating themselves from external competition (Bebchuk and Fried 2004; Vo and Canil 2016; Le et al. 2022). Anginer et al. (2020) defend new American legislation requiring the disclosure of CEO pay relative to median pay, given their finding that a high CEO pay slice lowers a company's cost of capital. Conversely, under tournament theory, a larger pay gap creates a substantial incentive for non-CEO executives to compete for the CEO role, thereby increasing the likelihood of CEO departure (Conyon et al. 2011; Chan et al. 2022).

Secondly, non-CEO executive behavior, particularly through insider trading, can also affect CEO turnover. Abnormal insider returns, defined as gains realized through

insider trading by senior executives, can signal the perceived performance of the CEO. For example, higher insider returns following stock purchases may indicate confidence in the CEO's leadership, reducing the probability of turnover. In contrast, higher insider returns from their sales than usual may indicate substandard CEO performance, increasing the probability of CEO turnover (Ye 2022; Kaplan and Minton 2012).

Thirdly, insider returns can interact with CEO pay disparity to either amplify or mitigate the likelihood of CEO turnover. For instance, if there are high insider purchasing returns and a small CEO pay gap, it could reinforce the belief that the CEO is performing well and so deserving of their position, leading to a decreased possibility of CEO turnover. On the other hand, if there are high insider selling returns and a significant CEO pay gap, it could strengthen the perception that the CEO is not performing satisfactorily and does not deserve high compensation, thereby increasing the likelihood of CEO turnover.

To the best of our knowledge, there is limited empirical research on the interaction between executive pay disparity and insider returns in predicting CEO turnover. Prior studies (Warner et al. 1988; Ye 2022) have touched upon this dynamic, but they omit a comprehensive exploration of how these two factors may jointly affect CEO dismissal. This paper aims to fill this gap by analyzing the interaction between non-CEO executives' insider returns and CEO pay disparity and how it influences the likelihood of CEO turnover. By doing so, we contribute to a deeper understanding of the determinants of CEO turnover, especially in contexts where executive pay structures and insider trading are prominent factors.

In summary, this paper makes several contributions to the literature on CEO turnover. First, we investigate the relationship between the insider abnormal returns of non-CEO executives and the probability of the CEO's dismissal by disentangling insiders' purchasing and sales, as this better signals the CEO's good or bad performance, reducing or increasing the likelihood of CEO turnover (as in insider purchases or sales, respectively). Second, we examine the relationship between executive pay disparity and CEO departures from two alternative theoretical perspectives. Under managerial power theory, the CEO's higher pay relative to non-CEO executives signifies their ability to influence the pay-setting process and obstruct effective CEO succession planning in order to maintain his/her position. In short, it reflects the "managerial power" of the CEO. In contrast, under tournament theory, a larger CEO pay slice motivates competition for the CEO position, thereby increasing the likelihood of CEO turnover. Third, we examine the interaction between insider returns and executive pay disparity on the likelihood of a CEO's dismissal. The difference in pay between the CEO and other executives can shape perceptions of the CEO's performance and the fairness of compensation. We posit that the combination of insider trading signals and pay disparity can either magnify or mitigate the likelihood of CEO turnover, depending on the context of the observed returns and pay structure.

The remainder of our paper is organized as follows. Section 2 discusses relevant literature and develops our hypotheses. Section 3 describes our data sample selection, variable definitions, and study methodology. Section 4 discusses our main empirical findings. Section 5 concludes the paper.

2. Literature Review and Hypotheses

2.1. The Independent Effect of Executive Pay Disparity on CEO Turnovers

Literature on CEO pay disparities reflects two different views on how CEO "power" influences CEO pay. Under the perspective of managerial power theory, a large CEO pay slice reflects greater CEO power, potentially leading to CEO entrenchment and a weak board (Bebchuk and Fried 2004; Lambert et al. 1993). In contrast, tournament theory proposes that a large CEO pay slice does not reflect managerial power but rather motivates other executives to work harder to attain the CEO's position (Lazear and Rosen 1981; Conyon et al. 2001).

2.1.1. Managerial Power Theory (Lambert et al. 1993)

According to the managerial power theory, CEO power is the CEO's ability to influence pay decisions made by the board of directors or the remuneration committee. Although firms may have independent directors on the compensation committee, CEO influence may still lead to decisions serving the CEO's interests, resulting in greater pay disparities. As such, CEO pay disparity reflects the CEO's managerial power and their ability to influence the pay setting. Recent studies (Vo and Canil 2016; Bebchuk et al. 2011) have confirmed that a larger CEO pay disparity can reduce the sensitivity of CEO turnover to performance. Bebchuk et al. (2011) show that a larger pay disparity between the CEO and other senior executives suggests a lower CEO turnover sensitivity to performance. In addition, Chen et al. (2013) report that higher CEO pay disparity implies a firm faces higher CEO succession risk. In order to maintain their position, the CEO may obstruct the development of an effective CEO succession plan and the career development of alternative CEO candidates. Consistent with this argument, Masulis and Mobbs (2011) suggest that firms with more entrenched CEOs rarely have high quality inside directors. As a result, the lack of a skilled replacement candidate in firms with higher CEO pay slices decreases the probability of CEO turnover for those firms.

This body of literature, however, lacks an in-depth exploration of how executive pay disparity, coupled with other organizational factors, influences CEO turnover in modern corporate governance structures. Our study seeks to fill this gap by investigating how executive pay disparity interacts with insider returns to influence CEO turnover, providing new insights into both managerial power and corporate decision-making processes. Based on this implication, we propose our first hypothesis:

Hypothesis 1: *Under a managerial power theory perspective, there exists a negative relationship between executive pay disparity and the likelihood of CEO turnover (H1).*

2.1.2. The Tournament Theory (Lazear and Rosen 1981)

Tournament theory argues that a large pay slice represents a huge incentive for those who compete for the CEO position (Lazear and Rosen 1981). The theory argues that since it is difficult to monitor individual abilities within the management team, it is efficient to pay individuals based on their ranked abilities, with larger pay at higher levels. Rosen (1986) suggests that in order to motivate the executives to stay in the game until the final round, pay must increasingly become larger as executives move up the hierarchy. Conyon et al. (2001) show that the CEO pay gap creates incentives for greater efforts from low-level executives and motivates them to raise their ranked position. Thus, rank-ordered pay represents a tournament prize that incentivizes other executives to win contests for promotion.

As such, under tournament theory, the compensation of the CEO is not directly tied to company performance; instead, executives are paid based on their ranked ability. If the CEO is paid significantly more than other executives in the company, this may be seen as unjustified by shareholders and stakeholders. In this scenario, shareholders and stakeholders may view the CEO pay gap as a reflection of poor corporate governance, and they may demand a change in leadership in order to align the CEO's interests with those of the company. This could lead to an increased likelihood of CEO turnover. Further, in order to compete in the CEO promotion tournament, contestants endeavor to make themselves look favorably to the board of directors. They may even engage in political sabotage to create a negative impression of the CEO's performance or that of a rival. Lazear (1989) documents that salary structures defined by organizational rank induce political sabotage amongst top- executives to increase their own chance of winning the contest. Bose et al. (2010) demonstrate that flatter pay profiles across the board can eliminate the incentive for sabotage and benefit the shareholders. Thus, if CEO pay is the top prize of the tournament, a positive association should exist between CEO pay disparity and CEO

turnover. Recently, Chan et al. (2022) documented that promotion tournaments weed out low-quality managers but also cause unintended turnover amongst high-quality managers.

This emerging literature highlights the dual effects of tournament structures on corporate performance, but it has not fully addressed how these dynamics interact with insider trading activities. The interaction between insider returns and executive pay disparity remains an underexplored area. Our research aims to address this gap by examining how tournament theory applies to the relationship between CEO turnover and insider returns. This leads to our second hypothesis.

Hypothesis 2: *Under the tournament theory perspective, there is a positive relationship between CEO pay disparity and the likelihood of CEO turnover (H2).*

2.2. The Independent Effect of Insider Returns on CEO Turnover

Research exploring the relationship between insider trading and CEO turnover is still relatively limited. While Niehaus and Roth (1999) provided early insights into this relationship in the context of equity issues, more recent studies, such as Ye (2022), have begun to investigate how insider trading events, like stock sales or purchases, can serve as indicators of CEO performance. Positive insider returns are often viewed as a signal of strong CEO performance, thereby reducing the likelihood of CEO turnover, while negative insider returns can indicate poor performance, increasing turnover likelihood (Edmans et al. 2017).

The information asymmetry hypothesis suggests that insider trading can be a factor contributing to CEO turnover. If earnings news is positive, higher insider returns may serve as a signal of the company's success, causing the CEO to retain their position. In such cases, positive insider returns may indicate that the CEO is making good decisions that benefit the company, suggesting less pressure for them to be removed. Conversely, if earnings news is negative, higher insider returns may signal poor CEO performance. This could increase the likelihood of CEO turnover. If insiders believe that the CEO is making poor decisions that are negatively impacting the company, they may push for a change in leadership. In both situations, insider returns affect the probability of CEO turnover.

The role of insider returns as a predictive factor for CEO turnover, particularly when considering interactions with executive pay disparity, remains largely unexamined. Our study aims to bridge this gap by investigating how insider returns interact with other governance mechanisms like executive pay disparity. We propose the following hypotheses:

Hypothesis 3: *Insider returns from insider purchases are negatively associated with CEO turnover (H3).*

Hypothesis 4: *Insider returns from insider sales are positively associated with CEO turnover (H4).*

2.3. The Impact of the Interaction Between Insider Returns and Executive Pay Disparity on the Likelihood of CEO Turnover

The impact of the interaction between insider returns and the CEO pay gap on CEO turnover is an interesting question that has not been extensively studied in the academic literature. It could potentially amplify or mitigate the independent effects that insider returns and the CEO pay gap can have upon CEO turnover, depending on the circumstances. For example, if the insider returns are high and the CEO pay gap is small, this could reinforce the perception that the CEO is doing a good job and deserves to keep their position, which could further reduce the likelihood of CEO turnover. In other words, the CEO is being fairly compensated for their performance, and the positive insider returns mean there is less pressure to remove the CEO. Conversely, smaller insider returns and a large CEO pay gap may lead to even higher CEO turnover. This could happen if insiders feel that the CEO is being overcompensated for their performance, creating tensions between the CEO and other insiders with lower insider returns, and thus, they may push stronger for a change in leadership.

On the one hand, having a large CEO pay slice suggests strong managerial power, thereby potentially reducing the ability of outside shareholders to monitor the firms (Bebchuk et al. 2011; Chen et al. 2013). This suggests that in the firms with larger CEO pay gaps, the lack of a quality board and ineffectiveness monitoring make CEOs more entrenched, thereby inducing other executives to exploit inside information in their stock trading to gain insider abnormal returns. An increase in insider purchase returns preceding any good news disclosures will offset the negative relationship between insider returns and CEO turnovers. An increase in insider selling returns preceding bad news disclosures will magnify the positive relationship between insider returns and CEO turnover. The above discussion leads to the following hypotheses.

Hypothesis 5: *Under a managerial power theory perspective, the interaction between the CEO pay slice and insider trading returns is positively associated with the likelihood of CEO turnover.*

On the other hand, the larger CEO pay disparity triggers other executives to compete for the CEO position; the more intense competition motivates executives to work harder, weed out low-quality managers, cause the unintended turnover of high-quality managers, improve the board quality, reduce the opportunism, reduce insider returns (Chan et al. 2022). This reduces the likelihood of CEO turnover. To compete in the CEO promotion tournament, contestants require firm-specific skills that are not beneficial if senior executives do not intend to stay for the long term. Therefore, these executives could seek other income sources rather than compete in the tournament to become CEO. Thus, a larger CEO pay disparity is conjectured to increase insider returns of non-CEO executives, as frustrated subordinates seek to gain advantage while remaining within a firm that frustrates their career ambitions. If CEO pay is the top prize of the tournament, we expect a relationship between CEO pay disparity and insider trading. A larger CEO pay disparity triggers other executives to compete for the CEO position, thereby increasing the probability of CEO turnover. This discussion leads to the following hypotheses:

Hypothesis 6: *Under a tournament theory perspective, the interaction between insider purchase returns prior to good earnings news and the CEO pay gap is positively associated with the likelihood of CEO turnover.*

3. Research Design

3.1. Analysis Framework

There might be several reasons for CEO turnover. Some CEO departures occur because of managerial behaviors that arise from managerial power, tournament perspectives, or the insider trading of executives, as analyzed in the previous section. Other CEOs are dismissed for reasons such as a CEO's low ability, personal scandals or violations of laws. Many CEOs depart voluntarily, e.g., accepting a better offer elsewhere or retiring. In reality, firms are not required to disclose the true reason for a CEO dismissal and are less likely to do so when firing a CEO. To distinguish between CEO departures induced by managerial pay disparity and other reasons, we introduce a concept of *pay-gap-induced turnover*, which refers to the replacement of top management motivated by either the level of the CEO's power or the scale of the tournament prize.

Conceptually, the probability of CEO turnover is modelled as the sum of two independent turnover probabilities, one of which is connected to the CEO pay slice and the other one is related to other determinants. Here, the CEO pay slice is calculated as the difference between the total pay of the CEO and the average pay of the other four senior executives, divided by the total pay of the top five executives. We denote this measure of CEO pay disparity as x_t ($x_t \geq 0$). The probability of CEO turnover is modelled as follows:

$$P(x_t) = G(x_t) + F(x_t) - G(x_t) * F(x_t) \quad (1)$$

where $P(x_t)$ is defined as the total probability of CEO turnover; $G(x_t)$ is the CEO *pay-gap-induced turnover*; and $F(x_t)$ is the probability of CEO turnover caused by other reasons.

The assumption, under the managerial power theorization, is that x_t reflects a CEO's ability to capture managerial power. Higher ability earns larger managerial power and, therefore, increases succession risk. We assume that when x_t is at or above a specific level of executive pay disparity, say $\mathcal{X}$, the CEO is more likely to entrench himself by obstructing the career development of other executives and not being willing to groom high-quality CEO, potential successors. We let $\kappa = x_t - \mathcal{X}$ denote the incentive level at which any value of $\kappa \geq 0$ is considered an incentive for the CEO to dominate other executives, behave opportunistically and entrench their CEO position. At a large enough level of CEO pay slice, such as the 80th percentile of the pay slice distribution, all turnovers observed at and above the $\mathcal{X}_{\text{large}}$ level are assumed to be unrelated to the managerial power of the CEO. Any higher turnover probability observed at the level below $\mathcal{X}_{\text{large}}$ is assumed to be caused by the lower level of managerial power of the CEO and, hence, their relative disposability. Therefore, the incentive level at $\mathcal{X}_{\text{large}}$ is defined as $\kappa_{\text{large}} = x_t - \mathcal{X}_{\text{large}}$.

We derive the empirical implications that arise in this framework from combining *pay-gap-induced turnover* with other sources of turnover.

Empirical implication 1

- The likelihood that CEO turnover is decreasing in the CEO incentive levels is given by the following constraint:

$$G(\kappa \geq 0) + F(\kappa \geq 0) - G(\kappa \geq 0) * F(\kappa \geq 0) < G(\kappa < 0) + F(\kappa < 0) - G(\kappa < 0) * F(\kappa < 0) \quad (2)$$

- The probability of *pay-gap-induced turnover* is zero at or above the large CEO pay slice $\mathcal{X}_{\text{large}}$ is given by the following constraint:

$$G(\kappa_{\text{large}} \geq 0) = \frac{P(\kappa_{\text{large}} \geq 0) - F(\kappa_{\text{large}} \geq 0)}{1 - F(\kappa_{\text{large}} \geq 0)} = 0 \quad (3)$$

The managerial power theory perspective predicts that for any level of CEO pay slice x_t , the returns to insider purchases are a credible signal of future CEO turnover. They are negatively associated with the probability of CEO departures; therefore, the likelihood of CEO turnover is decreasing in the returns to insider share purchases $r_{\text{purchases}}$.

$$P(r_{\text{purchases}}) < P(0) \quad (4)$$

The results derived in implication 1 (i) and (ii) follow immediately from the managerial power theory. Statement (i) establishes a negative relationship between the CEO pay slice and turnover. This is a standard prediction of the relationship between managerial power and CEO entrenchment. The result would hold true under the managerial power theory perspective when a higher pay disparity reflects the stronger power of the CEO (Bebchuk et al. 2011; Chen et al. 2013), thereby increasing CEO succession risk (Chen et al. 2013). The prediction carries over to our setup because the CEO is less likely to leave when the CEO pay slice remains high. Statement (ii) characterizes the abnormal returns to insiders' purchases as signals of CEO entrenchment. The prediction suggests that the CEO is less likely to depart after reaping high returns on their own purchases of their employer's stock.

In contrast to the managerial power theory perspective, x_t represents the tournament prize, which motivates other executives to work hard and compete for the CEO position. We denote $\kappa' = x_t - \mathcal{X}'$ as an incentive prize. At any value of $\kappa' \geq 0$, the other executives have an incentive to win the contest for promotion to higher levels. All the CEO exits observed below the level of $\mathcal{X}'$ are assumed to be unrelated to executive pay disparity. Any other turnover of our CEOs, observed at or above $\mathcal{X}'$, is assumed to be caused by the attempts of other executives to compete to attain the tournament prize. Hence, the

following empirical implication simplifies the theoretical predictions for the tournament theory perspective.

Empirical implication 2

- The probability of CEO turnover is increasing in the managerial incentive prize. So

$$G(\kappa' \geq 0) + F(\kappa' \geq 0) \pm G(\kappa' \geq 0) * F(\kappa' \geq 0) > G(\kappa' < 0) + F(\kappa' < 0) \pm G(\kappa' < 0) * F(\kappa' < 0) \quad (5)$$

- The probability of *pay-gap-induced turnover* is assumed to be zero at the level below the tournament prize κ'_{prize} , which is considered a starting point of the prize to induce other executives to enter the contest. κ'_{prize} is defined as the level of incentive prize equal to $x_t - \kappa'_{prize}$.

$$G(\kappa'_{prize} < 0) = \frac{P(\kappa'_{prize} < 0) - F(\kappa'_{prize} < 0)}{1 - F(\kappa'_{prize} < 0)} = 0 \quad (6)$$

- The likelihood of CEO turnover is increasing in the returns of insider sales r_{sales} .

$$P(r_{sales}) > P(0) \quad (7)$$

The first two statements in Empirical Implication 2 follow immediately from the tournament theory perspective. Statement (i) establishes a positive association between CEO turnover and the tournament prize measured by CEO pay disparity. Specifically, the model predicts that firms with a larger pay disparity tend to motivate other executives to compete for higher positions, thereby increasing the likelihood of CEO turnover. Statement (ii) predicts that at, or above, some high pay disparity level, contestants can attempt to pursue the CEO position by all means, even engaging in political sabotage to smear the CEO's reputation. Statement (iii) characterizes the abnormal returns of insiders' sales as the signals of forthcoming CEO dismissals. This prediction suggests that a CEO is more likely to be dismissed after large insider sales returns.

In order to investigate the impact of managerial pay disparity and insider trading on CEO turnover in a panel data environment, the likelihood of CEO turnover can be expressed by a modification of the standard probit model, which is stated below.

$$P(\text{turnover}_{i,t} = 1) = \phi[\alpha + \beta_1 \text{ARET}_{i,t-1} + \beta_2 \text{CPS}_{i,t-1} + \delta \mathbf{X}_{i,t}] \quad (8)$$

where the dependent variable is 1 if the CEO turnover occurs in year t and 0 otherwise. ϕ is the standard normal cumulative distribution function, i denotes each firm, and t represents the calendar year. The independent variable $\text{ARET}_{i,t-1}$ is average insider abnormal returns of firm i in year $t - 1$, pay with respect to the total pay of the top five executives. $\mathbf{X}$ denotes a vector of control variables. The definitions and measurements of the various variables are introduced in the next section.

3.2. Sample Selection

We gather information on insider transactions, managerial pay disparity, and CEO demographics (e.g., ages, tenures, CEO duality) from the Bloomberg database (Bloomberg L.P. 2020). Data pertaining to the firms' specifics, such as firm size and stock price, are collected from Refinitiv DataStream (Refinitiv DataStream 2020). CEO turnovers are manually collected from firms' annual reports.

Our sample represents the largest companies listed on major indices from eight countries: FTSE 100 (UK), DJIA (US), TSX 60 (Canada), ASX 50 (Australia), DAX (Germany), CAC 40 (France), AEX (Netherlands), and BEL 20 (Belgium). The sample period is between 2008 and 2019, which coincides with the most severe global financial crisis, 2008–2010, since the Great Depression. This crisis had a profound impact on the global economy, including on executive compensation and CEO turnover rates. Moreover, this period witnessed an increasing awareness and activism around social justice issues, specifically the diversity

and equity inclusion agenda. Particularly, income inequality and calls for social justice may have contributed to a heightened focus on the CEO pay gap. Furthermore, significant shifts in business models towards digitalization, and globalization occurred during this time, leading to increased competition that may have impacted CEO turnover rates.

Our final sample size is determined by specific criteria. Firstly, we require compensation data for the top five executives to be available. In cases where information on compensation is missing for any executive in a particular year, the data for that year will be excluded. Secondly, if firms are listed on multiple markets, we only retain the data from their primary listing market and remove the data from alternative markets. Finally, firms that were listed, or delisted from the indices after the study period commenced are also excluded. Through this screening process, our final sample comprises 2655 firm-year observations, derived from 23,310 insider transactions within 295 firms over an eleven-year period from 2008 to 2019. This dataset is further divided into 7377 insider purchases and 15,933 insider sales sub-samples.

3.3. Models and Measurements of Variables

We employ a probit model to examine the relationship between CEO turnover and several key independent variables. The dependent variable in our model is a binary variable that takes a value of 1 if the CEO left the firm in a fiscal year and 0 otherwise. Our key independent variables are the CEO pay slice, defined as the managerial pay disparity of the top five executives in the management team, and insider returns of the non-CEO executive in the top management team. In addition, we include three commonly used CEO characteristics that are known to influence CEO turnover: CEO age, tenure and CEO/Chair position duality. We also incorporate various firm fundamental variables as control variables, including firm size, accruals, free cash flow per-share, and the Tobin Q ratio. In order to calculate the average insider returns of non-CEO executives, we conduct an initial test using an event-day-study methodology. This allows us to analyse the stock price movements surrounding insider transactions and to evaluate the behaviour of insiders based on insider returns.

Insider abnormal returns

To measure insider abnormal returns, we use the market model (as described in (Brown and Warner 1985; MacKinlay 1997) and many subsequent studies) as it is widely accepted in the research literature. We estimate insider returns over five different event horizons: 60-day, 90-day, 120-day, 150-day and 180-day periods between day $t + 1$ and $t + 180$. The insider return of each transaction is defined as the abnormal return (RET_{it}) for sample firm i on the day t , which is measured as follows:

$$RET_{it} = [R_{it} - (\alpha + \beta * MR_t)] * \theta \quad (9)$$

where R_{it} is the actual returns of firm i on day t . MR_t is the market return on day t . θ is a binary variable for the direction of trade, which takes the value of +1 if the trade is a “Buy” and -1 if it is a “Sell”. The insider abnormal returns for sales are multiplied by -1 due to the fact that insiders make abnormal profits when share prices fall after insider sales. The average insider returns ($ARET_{it}$) is calculated as the weighted average of total returns, RET_{it} , insiders made in a given year.

$$ARET_{it} = \sum_{t=1}^n \frac{[R_{it} - (\alpha + \beta * MR_t)] * \theta}{n} \quad (10)$$

where ARET60, ARET90, ARET120, ARET150 and ARET180 denote average insider abnormal returns for a horizon of 60, 90, 120, 150 and 180 days, respectively.

CEO pay disparity

We measure executive pay disparity as total CEO compensation divided by the total compensation of the top five executives. We focus on cash compensation for several reasons.

First, cash compensation is used in previous studies (Eriksson 1999; Bognanno 2001; Shen et al. 2010). Second, it is easy to calculate. Third, cash compensation is robust to future movements in the share price and earnings that will influence stock options and long-term incentive plan payouts, which could induce a correlated error in the pay slice metric, inducing an unwanted endogeneity in reported tests.

CEO characteristics variables

We control for CEO characteristics using three wide measures—CEO age, tenure and duality. Coates and Kraakman (2010) and Jarva et al. (2019) document that CEO age is more important in explaining CEO turnover than measures of firm performance. These studies suggest that the probability of a CEO leaving office is positively associated with the CEO's age. Jarva et al. (2019) also find evidence of a negative association between CEO age and enforced CEO turnover and a positive association between the age of a CEO and voluntary turnover. Regarding CEO tenure, Coates and Kraakman (2010) and Jenter and Kanaan (2015) argue that long-tenure CEOs should have proven their ability in both good and bad times; thus, tenure should be negatively related to the probability of CEO turnover. Finally, we include a dummy variable of duality indicating whether the CEO is also the board Chair. It takes a value of 1 when the CEO holds the board chair position and 0 otherwise. Zajac and Westphal (1996) and subsequent literature find that CEOs who hold the chair position concurrently tend to have more subsequent appointments to boards due to their greater control over management. Consistent with prior literature, we expect the CEO who holds the chair position to display a higher level of entrenchment.

Firm characteristics variables

Following extensive empirical literature on corporate finance, we use a number of control variables that have been documented to influence CEO turnover, including accounting accruals, operating cash flow per share, Tobin's Q ratio, tenure and firm size (Anderson et al. 2018; Jenter and Kanaan 2015; Jenter and Lewellen 2014; among others).

Earnings management, proxied by accruals, represents the earnings portion that the managers can discretionally exercise under an auditor's supervision. Earnings management suggests that CEOs take action by increasing accounting earnings, thereby entrenching their position. If CEOs are dismissed for poor firm performance and have discretion over the performance measures used by the board in termination decisions, then the CEOs who face a high probability of being dismissed will have incentives to adjust accounting accruals in their favor. As such, an increase in accounting accruals is evidence of the amount of managerial discretion of the CEO.

To control for firm performance, we include the operating cash flow per-share, denoted as OCFPS. We include Tobin's Q ratio to capture the firm's growth prospects. CEO tenure is included in our model to reflect the impact of firm performance on CEO turnover. Finally, we measure firm size using the natural logarithm of market capitalization. We expect that the CEO of a larger firm has a lower probability of entrenchment due to a higher level of supervision through a larger board.

Probit Model Specification

We employ the probit model to assess the impact of the CEO pay disparity and insider trading returns of non-CEO executives on the probability of a CEO's exit from the firm. CEO turnover is identified when the CEO of a firm is different from the CEO in the preceding year. To avoid the incidental parameters problem, which arises in the context of nonlinear panel models, we do not include fixed effects in the probit models (Kaplan and Minton 2012; Jenter and Lewellen 2014). It is noteworthy that Chung et al. (2024) report that the CEO pay slice and firm performance may have a U-shaped relationship. Our main regression model can be expressed as follows:

$$P(\text{turn}_{i,t} = 1) = \phi \left[\alpha + \beta_1 \text{ARET\_1}_{i,t-1} + \beta_2 \text{CPS\_1}_{i,t-1} + \beta_3 (\text{ARET\_1}_{i,t-1} - \text{mean ARET\_1}_{i,t-1}) * (\text{CPS\_1}_{i,t-1} - \text{mean CPS\_1}_{i,t-1}) + \ln \text{AGE}_{i,t} + \ln \text{TENURE}_{i,t} + \text{DUAL}_{i,t} + \text{ACCRUALS\_1}_{i,t-1} + \text{OCFPS\_1}_{i,t-1} + \text{Qratio}_{i,t} + \text{SIZE\_1}_{i,t-1} + e_i \right] \quad (11)$$

where ϕ is the standard normal cumulative distribution function, i indicates a particular firm and t denotes the financial year. The dependent variable of the model is CEO turnover, which takes a value of 1 if the CEO left the firm in a fiscal year and 0 otherwise. The independent variables are defined as follows: $\text{ARET\_1}_{i,t-1}$ is the average abnormal returns of non-CEO executives of firm i at year $t - 1$, $\text{CPS\_1}_{i,t-1}$ is defined as a CEO pay slice of firm i at year $t - 1$ and $(\text{ARET\_1}_{i,t-1} - \text{mean ARET\_1}_{i,t-1}) * (\text{CPS\_1}_{i,t-1} - \text{mean CPS\_1}_{i,t-1})$ is the interaction of the first two independent variables. $\ln \text{AGE}_{i,t}$ is the natural logarithm of CEO age, $\ln \text{TENURE}_{i,t}$ is the natural logarithm of CEO tenure, measured as the number of years that the CEO has held the CEO position, $\text{DUAL}_{i,t}$ is CEO duality that takes a value of 1 if the CEO also serves as board Chair at the same time and 0 otherwise. The variables $\text{ACCRUALS\_1}_{i,t-1}$, $\text{OCFPS\_1}_{i,t-1}$ and $\text{SIZE\_1}_{i,t-1}$ are defined as accounting accruals, operating cash flow per share and firm size of firm i at year $t - 1$, respectively. $\text{Qratio}_{i,t}$ is measured by Tobin's Q ratio of firm i at year t . The variable definitions are summarized in Table 1 below.

Table 1. Variable definitions.

Variables		Definitions
Dependent variable:		
$\text{Turn}_{i,t}$	CEO turnover	The variable takes 1 if the CEO left the firm i in a fiscal year t and 0 otherwise.
Independent variables:		
$\text{ARET\_1}_{i,t-1}$	Abnormal return	The average abnormal return of non-CEO executives of firm i at year $t - 1$
$\text{CPS\_1}_{i,t-1}$	CEO pay slice	a CEO pay slice of firm i at year $t - 1$
$(\text{ARET\_1}_{i,t-1} - \text{mean ARET\_1}_{i,t-1}) * (\text{CPS\_1}_{i,t-1} - \text{mean CPS\_1}_{i,t-1})$	Interaction term	The interaction of the first two independent variables.
$\ln \text{AGE}_{i,t}$	CEO age	The natural logarithm of CEO age
$\ln \text{TENURE}_{i,t}$	CEO tenure	The natural logarithm of CEO tenure, measured as the number of years that the CEO has held the CEO position.
$\text{DUAL}_{i,t}$	CEO duality	Equals 1 when the positions of CEO and Chairman are held by the same person, and zero otherwise.
$\text{ACCRUALS\_1}_{i,t-1}$	Accounting accruals	The difference between accounting earnings and cash flows of firm i and year $t - 1$
$\text{OCFPS\_1}_{i,t-1}$	Operating cashflow	Operating cash flow-per share of firm i at year $t - 1$
$\text{SIZE}_{i,t-1}$	Board size	Firm size of firm i at year $t - 1$
$\text{Qratio}_{i,t}$	Tobin's Q ratio	Tobin's Q ratio of firm i at year t

4. Empirical Results

4.1. Descriptive Statistics

4.1.1. Insider Cumulative Abnormal Returns

Our total sample contains 23,310 insider transactions executed by non-CEO executives. The sample is split into two separate subsamples based on the type of transaction: purchases and sales. Specifically, there are 7377 purchase transactions and 15,933 sales transactions. Table 2 reports the cumulative abnormal returns of non-CEO executives (denoted as RETs) and provides differences in mean tests over five different horizons between 0 and 180 days. In general, mean RETs for most event periods are significantly different from zero. The average RETs calculated from our sale sample of 15,933 events are significantly larger

than those for the purchase sample of 7377 events. We also find that the mean ARETs are significantly different for the Buy and Sell samples.

Table 2. RETs of insider trading activities for different event periods.

Event Period	BUY		SELL		Mean Difference Test
	Total Sample (N = 7377)		Total Sample (N = 15,933)		
	RET	t-Value	RET	t-Value	
[0 to 60]	0.891 ***	5.19	1.952 ***	17.83	−11.99 ***
[0 to 90]	1.295 ***	5.99	3.042 ***	21.27	−14.05 ***
[0 to 120]	2.071 ***	7.11	4.07 ***	22.99	−16.22 ***
[0 to 150]	2.545 ***	8.08	5.168 ***	25.80	−17.80 ***
[0 to 180]	2.889 ***	8.59	5.872 ***	26.57	−18.00 ***

Notes: This Table reports the cumulative abnormal returns (RETs) by insiders for the Buy and Sell sample. The Buy/Sell sample includes the events with insider purchases. The mean difference in returns test shows the t-value for the mean difference in RETs between insider buy and sell samples. A positive (negative) value in the difference in the mean test indicates that there is a higher (lower) value for the buy sample compared to that of the sell sample. Here, *** denotes significance at the 1% level of significance.

4.1.2. CEO Turnovers

In line with previous literature (Anderson et al. 2018; Jenter and Kanaan 2015; Jenter and Lewellen 2014), we define a turnover event if the CEO in year t is not the same as the CEO in year $t - 1$.

4.1.3. Other Independent Variables

Abnormal returns for insider transactions are averaged across years using Equation (10). We observe 2360 and 2344 firm-year average abnormal returns for purchase and sale samples, respectively. Panel A of Table 3 presents the descriptive statistics of average cumulative abnormal returns of non-CEO executives (denoted as ARETs) over our five different horizons between 0 and 180 days. Panel B reports summary statistics for CEO pay disparity, age, tenure and other independent variables. Columns (1) to (3) display summary statistics for the Buy subsample, while columns (4) to (6) show those of the Sell subsample. Columns (7), (8) and (9) report the minimum, average and maximum values for the whole sample, respectively.

Panel A illustrates that the mean ARETs increase as the event horizon expands. The average insider returns of the buy sample for a period of 60 days [0 to 60], denoted ARET60, is recorded at 0.69%. This value increases to 2.03% as the event period extends to 180 days (ARET180). Meanwhile, the mean value of ARET60 for the sell sample is recorded at 1.07% for the horizon [0 to 60] and increases to −2.93% for the full horizon [0 to 180]. This indicates that the market reacts positively to insider purchases and negatively to insider sales as the event window lengthens, suggesting that equity markets see insider trading as signaling emergent corporate value. On average, cumulative abnormal returns of insiders' sales are higher than those of the buy sample, implying that markets react to negative inside information more strongly than the positive information heralded by purchases.

Panel B presents summary statistics of the other eight independent variables included in the probit model. To minimize the effect of outliers, we winsorize all continuous variables at the 1st and 99th percentiles. The mean CEO pay disparity proxied by the CEO pay slice, CPS, of our purchase sample is slightly lower than that of the sale sample. The lowest-paid CEO receives 1.2% of the total cash payment to the top management team, while the best-paid is recorded as earning a salary equal to the sum of the top five executives' combined pay. The data for CEO age lies between 32 and 81 with an average age of 54. CEO tenure varies, with the shortest duration being 1 year while the longest is nearly 30 years, and the average period that a CEO remains in office is 5.7 years, which is consistent with this value recorded in subsamples. Panel B reports that 15.9% of CEOs also hold the Chair

of their boards on average. This ratio is 16.3% and 15.4% for insider purchase and sale samples, respectively.

Table 3. Descriptive Statistics.

PANEL A: Average abnormal returns									
	Buy Sample			Sell Sample			Full Sample		
	N	Mean	St. Dev.	N	Mean	St. Dev.	Min	Mean	Max
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ARET60	2360	0.695	8.82	2344	1.07	7.695	−54.835	−0.185	82.229
ARET90	2360	1.056	11.647	2344	1.634	10.225	−79.963	−0.284	122.337
ARET120	2360	1.65	15.186	2344	2.128	13.529	−121.966	−0.233	175.345
ARET150	2360	1.833	18.127	2344	2.707	15.798	−163.54	−0.429	199.956
ARET180	2360	2.031	20.369	2344	2.935	18.411	−199.974	−0.444	265.564
PANEL B: Other independent variables									
Ind. Variables	Buy Sample			Sell Sample			Full Sample		
	N	Mean	St. Dev.	N	Mean	St. Dev.	Min	Mean	Max
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CPS	2050	0.468	0.215	2058	0.474	0.22	0.012	0.471	1
CEOAGE	2056	54.126	5.904	2062	54.133	5.885	32	54.129	81
TENURE	2093	5.698	4.855	2098	5.717	4.855	1	5.708	29.7
DUAL	2208	0.163	0.37	2213	0.154	0.361	0	0.159	1
ACCRUALS	2541	0.007	0.075	2546	0.006	0.074	−0.93	0.007	0.576
OCFPS	2518	1.749	4.833	2518	1.771	4.59	−38.085	1.76	87.763
QRATIO	2215	1.667	0.978	2220	1.677	0.977	0.557	1.672	13.856
SIZE	2460	9.507	1.344	2464	9.483	1.348	4.44	9.495	13.381

Notes: This Table reports descriptive statistics (i.e., mean, median, and standard deviation) for a sample of insider transactions executed by non-CEO directors between 2008 and 2016. Panel A presents a summary of ARETs in 5 event periods in percentage terms; Panel B reports summary statistics of other independent variables; CPS is a proxy of CEO pay disparity, the CEO's pay slice, measured as a ratio of the total CEO pay divided by the total pay of top five executives. CEOAGE is the CEO's age in year t ; TENURE is CEO tenure, equals the number of years the CEO has taken the position; DUAL is CEO duality, coded 1 if the CEO has also taken the position of Chair of the Board, and 0 otherwise. ACCRUALS is the difference between earnings and cash flows; OCFPS is operating cash flow per-share. QRATIO is measured by the Tobin Q ratio of a firm. SIZE is defined as the firm size as measured by the natural logarithm of the total market capitalization of a firm.

Table 3 provides summary statistics of the firm-specific variables. There are slight differences in the mean and standard deviation between the two subsamples. Specifically, the mean values of ACCRUALS and SIZE are recorded at 0.007 and 9.507 for the buy sample, compared to 0.006 and 9.485 for the sell sample. The average values of OCFPS and QRATIO of the buy sample are 1.749 and 1.667. These are slightly lower than those of the sell sample, which are 1.771 and 1.677, respectively.

4.1.4. Correlation Between Variables

Figures 1 and 2 report correlation coefficients of Buy and Sell samples between the main independent variables and control variables. To simplify, we use ARET90 (the average insider abnormal returns of the 90-day event period) as a representation of the average insider returns of non-CEO executives. At a glance, it is clear that the highest correlation coefficient in Figures 1 and 2 is 0.31, implying that there is no multicollinearity in our models. This coefficient is observed for the association between CEO age and duality for both subsamples, indicating that older CEOs are more likely to hold the board chair. Lagged CPS and firm size exhibit a significant and negative association with a correlation coefficient of −0.17 and −0.18 for the buy and sell samples, respectively. This suggests that larger firms tend to have a smaller pay disparity between the CEO and other executive directors. Similar results are observed in the correlation between firm size and each of the variables, CEOAGE, DUAL and lagged OCFPS. In particular, CEOAGE and SIZE have a

correlation coefficient of 0.28, suggesting that larger firms tend to hire more experienced CEOs. The coefficient of 0.27 between firm size and CEO duality indicates that more CEOs Chair boards for larger companies. The positive correlation between SIZE and OCFPS_1 reveals that larger firms usually generate higher amounts of operating cash flow.

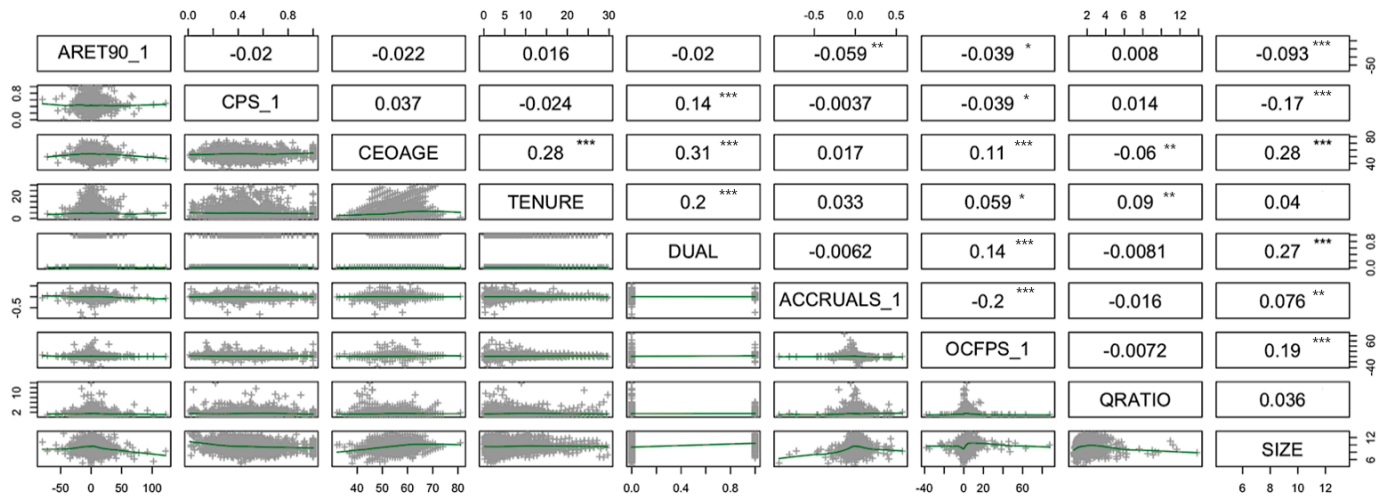


Figure 1. Correlations coefficients of the insider buy sample. Notes: This Figure displays the correlation coefficients between our independent variables and their scatter plots with a fitted line. A star indicates the test is significant at the 10% confidence interval, ** significant at the 5% confidence interval and finally, *** significant at the 1% confidence interval.

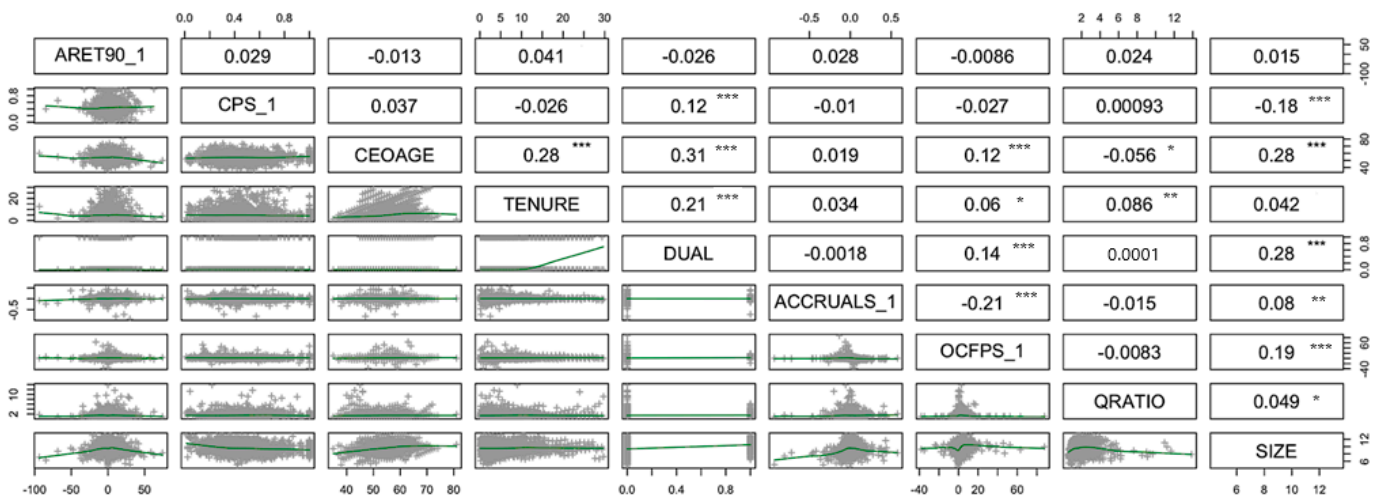


Figure 2. Correlations coefficients of insider sell sample. Notes: This Figure displays the correlation coefficients between our independent variables and their scatter plots with a fitted line. A star indicates the test is significant at the 10% confidence interval, ** significant at the 5% confidence interval and finally, *** significant at the 1% confidence interval.

The correlation coefficients between lagged average insider returns and the other variables differ significantly between the two Figures. Figure 1 reports a significant and negative relationship between lagged average insider returns denoted as ARET90_1, ACCRUALS_1 and SIZE, whereas we find no significant associations between ARET90_1 and the other variables. Figures 1 and 2 document low correlation coefficients between the variables. This mitigates any multicollinearity concerns that could affect our regression results.

4.2. Main Analysis

4.2.1. Insider Purchases

Table 4 presents the results of our probit regression analysis examining the relation between CEO turnover and our variables of interest for the insider purchase subsample. The first five columns of the Table display the regression results for five event horizon periods from [0–60] days to [0–180] days. The numbers in square parentheses show the length of the event period, corresponding to each of the average insider abnormal returns (ARETs) in different models. For instance, [0–60] and [0–180] denote the corresponding ARET of 60-day and 180-day event periods for models (1) and (5), respectively. Columns (6) to (10) report the implied marginal effects, which give the impact upon the probability of a CEO departing of a one-unit increase in an explanatory variable when other variables are held at their mean values. To account for potential heteroscedasticity and serial correlation for individual firms over time, robust standard errors are calculated. The Table shows evidence of a negative and significant association between CEO turnover and the CEO pay slice. CPS, in all the regression models, suggests that an increase in pay disparity between the CEO and other board executives in the top management team leads to greater entrenchment of the CEO. This result is consistent with the managerial power theory that argues executive pay disparity reflects the concentration of the CEO's power. A larger pay disparity represents a greater ability of the CEO to capture managerial power, thereby cementing their position (Bebchuk et al. 2011; Chen et al. 2013). For instance, the marginal effects in model (3), summarized column (7), imply that an increase of 1% in CPS can cause a decrease of 7.7% in the probability of CEO turnover.

The results in Table 4 also demonstrate a significant and negative correlation between ARETs of the 60-day and 90-day event periods and CEO turnover, supporting hypothesis H3. This negative coefficient implies that the returns of non-CEO executive stock purchases in the previous year are a credible signal of the likelihood of CEO departure each year. In other words, the firms with greater insider buying returns are less likely to experience CEO turnover, and vice versa. For example, the results in model (2) suggest that a decrease of 1% in insider returns is a signal of a 0.4% increase in the probability that a CEO exits the firm (estimated marginal effects reported in model (2)). These results confirm our conjecture in the first hypothesis that insider returns from stock purchases by non-CEO executives reduce the likelihood of CEO turnover. However, this relation is only significant in models (1) and (2), suggesting that the insider returns of longer event windows are not predictive of CEO turnover.

Although both CPS and insider returns have a significant negative effect on the probability of CEO turnover, support our hypotheses H1 and H3, the interaction term between these two variables is positive and significant at the 5% confidence level for models (1) and (2), support our hypothesis H6. This finding indicates that the higher the CPS, the more positive the effect of insider returns is on the probability of CEO turnover. The positive coefficient on the interaction term implies that CEOs in firms with larger CEO pay disparity and higher informative insider purchases are more likely to depart from their positions. CEOs in higher pay disparity firms may neglect their main duties and opportunistically focus on capturing the pay process of the firm to pursue their own agendas, potentially reducing their firms' performance and damaging corporate governance structures (Bebchuk et al. 2011; Park 2017). Furthermore, CEOs within high CPS firms have a greater tendency to obstruct effective CEO succession planning by obstructing the career development of rivals for their job. This constrained competition for the CEO position may lead other executives to look for alternative income streams by exploiting inside information for personal gains. Dai et al. (2016) argue that insiders in poorly governed firms are more likely to exploit inside information. Therefore, we can conclude that the probability of CEO turnover in firms with uncertain growth prospects increases with the returns of insider purchases when there is a positive effect of the CPS of that firm.

The positive coefficient of $\ln$ CEOAGE indicates that older CEOs are more likely to leave, often via retirement. This result concurs with the results reported by Coates

and Kraakman (2010). Furthermore, the positive relation between CEO tenure and CEO turnover suggests that CEOs with longer tenure are more likely to be dismissed, potentially due to their weakness becoming more apparent to boards over time. Alternatively, it is possible that departing is simply less troublesome for longer-tenure CEOs (who may often just retire). These results differ from those of Jenter and Kanaan (2015). Another CEO characteristic worth examining is CEO duality (DUAL), which exhibits a significantly negative relationship with CEO departure, implying that CEOs who simultaneously hold the position of a Board chair possess greater managerial power, making them less likely to be dismissed. This finding intuitively supports the notion that duality empowers the CEO and hinders the initiation of CEO turnover by the board.

Table 4. Insider returns, executive pay disparity and CEO turnover—Results from the main regression model—buy sample.

	Dependent Variable: CEO Turnover									
	Coefficients (<i>p</i> -Value)					Marginal Effects (<i>p</i> -Value)				
	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CPS_1	−0.499 ** (0.031)	−0.472 ** (0.040)	−0.461 ** (0.044)	−0.469 ** (0.041)	−0.481 ** (0.037)	−0.081 ** (0.029)	−0.077 ** (0.038)	−0.075 ** (0.042)	−0.077 ** (0.039)	−0.078 ** (0.035)
ARET60_1	−0.026 * (0.064)					−0.0041 * (0.062)				
INTERACTION60	0.058 ** (0.040)					0.009 ** (0.038)				
ARET90_1		−0.025 ** (0.024)					−0.004 * (0.063)			
INTERACTION90		0.046 ** (0.038)					0.007 ** (0.036)			
ARET120_1			−0.009 (0.258)					−0.001 (0.257)		
INTERACTION120			0.017 (0.315)					0.003 (0.315)		
ARET150_1				−0.009 (0.198)					−0.001 (0.197)	
INTERACTION150				0.016 (0.232)					0.002 (0.231)	
ARET180_1					−0.009 (0.157)					−0.001 (0.156)
INTERACTION180					0.018 (0.154)					0.002 (0.152)
lnCEOAGE	3.138 *** (0.000)	3.136 *** (0.000)	3.155 *** (0.000)	3.152 *** (0.000)	3.148 *** (0.000)	0.508 *** (0.000)	0.508 *** (0.000)	0.516 *** (0.000)	0.515 *** (0.000)	0.514 *** (0.000)
lnTENURE	0.278 *** (0.000)	0.277 *** (0.000)	0.270 *** (0.000)	0.270 *** (0.000)	0.270 *** (0.000)	0.0451 *** (0.000)	0.045 *** (0.000)	0.044 *** (0.000)	0.044 *** (0.000)	0.044 *** (0.000)
DUAL	−0.640 *** (0.000)	−0.631 *** (0.000)	−0.646 *** (0.000)	−0.643 *** (0.000)	−0.641 *** (0.000)	−0.079 *** (0.000)	−0.078 *** (0.000)	−0.08 *** (0.000)	−0.080 *** (0.000)	−0.079 *** (0.000)
ACCRUALS_1	−1.945 *** (0.003)	−1.951 *** (0.003)	−1.974 *** (0.003)	−1.974 *** (0.003)	−1.946 *** (0.003)	−0.315 *** (0.0026)	−0.316 *** (0.002)	−0.323 ** (0.002)	−0.323 *** (0.002)	−0.317 *** (0.002)
OFCPS_1	−0.022 * (0.057)	−0.020 * (0.074)	−0.019 (0.101)	−0.019 * (0.090)	−0.019 * (0.088)	−0.0035 * (0.055)	−0.003 * (0.072)	−0.003 * (0.099)	−0.003 * (0.088)	−0.003 * (0.086)
Qratio	0.013 (0.773)	0.012 (0.798)	0.012 (0.789)	0.013 (0.789)	0.014 (0.769)	0.002 (0.772)	0.002 (0.791)		0.002 (0.780)	0.002 (0.768)
SIZE_1	−0.009 (0.822)	−0.017 (0.664)	−0.016 (0.687)	−0.015 (0.689)	−0.015 (0.705)	−0.001 (0.821)	−0.003 (0.660)	−0.002 (0.686)	−0.002 (0.688)	−0.002 (0.704)
Constant	−13.791 *** (0.000)	−13.711 *** (0.000)	−13.791 *** (0.000)	−13.777 *** (0.000)	−13.768 *** (0.000)					
Observations	1582	1582	1582	1582	1582					

Notes: This Table reports the probit and marginal effects estimations for CEO turnover for the five different horizons of insider purchases. Columns (1) to (5) report the probit coefficients, and columns (6) to (10) report the marginal effects; CPS_1 is a proxy of one-year lagged CEO pay disparity, measured as a ratio of the total CEO pay divided by total pay of top five executives; ARETs with suffix [60_1 to 180_1] are defined as the lagged average abnormal returns of non-CEO executives for different event windows from 60 to 180-day period, respectively; lnCEOAGE is the natural logarithm of the CEO age in the year *t*; lnTENURE proxies for CEO tenure, this is the natural logarithm of the number of years that CEO have taken the position; DUAL, CEO duality, is coded 1 when the CEO also held the chair position, 0 otherwise. The variable ACCRUALS_1 is lagged accounting accruals, which is the difference between earnings and cash flows; OFCPS_1 is the lagged operating cash flow per share. QRATIO is the measure of the Q-ratio of a firm. SIZE_1 is defined as the firm size recorded in year *t* − 1, measured as the natural logarithm of the total market capitalization of a firm. *p*-values are reported in parentheses below the coefficient estimates. The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

For an inspection of CEO characteristics variables, our results show that the likelihood of CEO turnover is significantly and positively associated with CEO age and tenure, both at the 1% confidence level. The positive coefficient of $\ln\text{CEOAGE}$ indicates that older CEOs have a greater tendency to be replaced. This discovery is consistent with the results reported by Coates and Kraakman (2010). Furthermore, the positive relation between CEO tenure and CEO turnover suggests that CEOs with longer tenure are more likely to be dismissed, potentially due to their weakness becoming more apparent to boards over time. Alternatively, it is possible that departing is simply less troublesome for longer-tenure CEOs. These results differ from those of Jenter and Kanaan (2015). Another CEO characteristic is CEO duality (DUAL). The results in Table 4 report a significantly negative relationship between CEO departure and DUAL. This finding intuitively supports the notion that duality empowers the CEO and hinders the initiation of CEO turnover by the board.

Regarding the firm characteristics, our results provide evidence supporting our above conclusions in relation to CEO turnover. The coefficients of lagged earnings management (ACCRUALS_1) are positive and significant at the 1% level for all event windows, while lagged operating cash flow per share (OCFPS_1) is negatively associated with CEO turnover at the 10% level of significance for all cases except model (3). The evidence of the negative relationship between ACCRUALS_1 and CEO turnover suggests that CEOs may attempt to increase reported earnings via accruals management to secure their reputation and retain their CEO positions. A negative coefficient on OCFPS_1 indicates that a firm's bad performance may induce a CEO dismissal. With respect to firm size and growth, we find no evidence of the relationship between these two variables and the likelihood of CEO departure, suggesting that the probability of CEO dismissal is broadly equal among firms, varying by size or growth prospects.

Overall, the regression results for the insider buying sample support the managerial power theory perspective and are consistent with our first hypothesis that insider returns credibly signal future CEO departures. The results also report the significance of interaction terms, suggesting that an increase in CEO managerial power, driven by the CPS, is likely to deepen the CEO's entrenchment. Interestingly, a positive coefficient on the interaction term of these two variables suggests that an increase in insider buying returns, with a positive effect of the CPS, may worsen a firm's prospects, hence increasing the likelihood of the CEO's dismissal.

4.2.2. Insider Sales

To investigate whether the impact of insider sales returns on CEO turnover differs from those of insider purchasing returns, we repeat our empirical analysis for the sell subsample across the five horizons. The results of our investigations are reported in Table 5. The first five columns of Table 5 display the estimates for five event windows from [0–60] days to [0–180] days, corresponding to five average abnormal returns from ARET_{60} to ARET_{180} . Our results provide no evidence of the direct relationship between CEO pay disparity (CPS_1) and the probability of CEO turnover for the sell sample, rejecting hypothesis H2. In contrast to the results for insider returns for the buy sample, the significant and positive coefficients on insider return variables of the five models demonstrate that returns of insider stock sales are significantly and positively associated with an increasing likelihood of CEO dismissal. This supports Hypothesis 4, which conjectures a positive association between CEO turnover and returns of insider sales. The positive coefficients on ARETs imply that insider selling returns are also a credible signal of impending future CEO turnover, indicating that insiders may exploit their insider information about the poor performance of CEOs before turnover events.

Despite the lack of evidence on the direct impact of CEO pay disparity on CEO dismissals within the insider sales sample, the interaction term $(\text{ARET}_{1,i,t-1} - \text{mean ARET}_{1,i,t-1}) * (\text{CPS}_{1,i,t-1} - \text{mean CPS}_{1,i,t-1})$, shows that CPS has a negative impact on the relation be-

tween insider selling returns and the probability of CEO turnover, consistent with our hypothesis H5. A negative coefficient on the interaction term in all five models suggests that a decrease compared to the previous year's CEO pay slice (CPS_1) leads to a stronger positive association between insider stock sale returns and the probability of a CEO dismissal. For instance, the coefficient of (ARET90_1*CPS_1) in model (2) [marginal effects estimation reported in model (6)] reports a negative association between returns of insider sales for the 90-day window and CEO turnover. This relationship is statistically significant at the 1% level for all four models. This means that an increase of 1% in insider selling return can increase the probability of a CEO being dismissed by 0.1% when the CPS of the firm falls by 1%. This probability only increases by 0.5% when there is no effect of CPS.

Table 5. Insider returns, executive pay disparity and CEO turnover—Results from the main regression model—sell sample.

	Dependent Variable: CEO Turnover																			
	Coefficients										Marginal Effects									
	[0–60]		[0–90]		[0–120]		[0–150]		[0–180]		[0–60]		[0–90]		[0–120]		[0–150]		[0–180]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CPS_1	−0.339 (0.121)	−0.32 (0.144)	−0.339 (0.120)	−0.343 (0.117)	−0.349 (0.110)	−0.055 (0.119)	−0.052 (0.142)	−0.055 (0.118)	−0.056 (0.114)	−0.058 (0.108)										
ARET60_1	0.036 (0.018)	**				0.005 (0.017)	**													
INTERACTION60	−0.075 (0.013)	**				−0.012 (0.012)	**													
ARET90_1		0.032 (0.005)	***					0.005 (0.004)	***											
INTERACTION90		−0.066 (0.004)	***					−0.010 (0.003)	***											
ARET120_1			0.019 (0.011)	**									0.003 (0.010)	**						
INTERACTION120			−0.040 (0.011)	**									−0.006 (0.010)	**						
ARET150_1				0.016 (0.021)	**													0.002 (0.019)	**	
INTERACTION150				−0.029 (0.037)	**													−0.004 (0.036)	**	
ARET180_1					0.012 (0.033)	**													0.002 (0.032)	**
INTERACTION180					−0.022 (0.057)	*													−0.003 (0.059)	*
lnCEOAGE	3.168 (0.000)	***	3.213 (0.000)	***	3.214 (0.000)	***	3.239 (0.000)	***	3.228 (0.000)	***	0.520 (0.000)	***	0.525 (0.000)	***	0.528 (0.000)	***	0.534 (0.000)	***	0.534 (0.000)	***
lnTENURE	0.262 (0.000)	***	0.259 (0.000)	***	0.258 (0.000)	***	0.253 (0.000)	***	0.253 (0.000)	***	0.043 (0.000)	***	0.042 (0.000)	***	0.042 (0.000)	***	0.041 (0.000)	***	0.041 (0.000)	***
DUAL	−0.666 (0.000)	***	−0.661 (0.000)	***	−0.656 (0.000)	***	−0.657 (0.000)	***	−0.657 (0.000)	***	−0.082 (0.000)	***	−0.081 (0.000)	***	−0.081 (0.000)	***	−0.081 (0.000)	***	−0.082 (0.000)	***
ACCRUALS_1	−1.945 (0.003)	***	−1.993 (0.002)	***	−2.024 (0.002)	***	−2.014 (0.002)	***	−2.016 (0.002)	***	−0.319 (0.002)	***	−0.325 (0.001)	***	−0.332 (0.001)	***	−0.332 (0.001)	***	−0.332 (0.001)	***
OFCPS_1	−0.018 (0.140)		−0.020 (0.095)	*	−0.020 (0.088)	*	−0.019 (0.116)		−0.018 (0.131)		−0.002 (0.138)		−0.003 (0.094)	*	−0.003 (0.086)	*	−0.003 (0.115)		−0.003 (0.129)	
Qratio	0.015 (0.743)		0.014 (0.761)		0.014 (0.763)		0.015 (0.745)		0.014 (0.763)		0.002 (0.743)		0.002 (0.760)		0.002 (0.762)		0.002 (0.744)		0.002 (0.762)	
SIZE_1	−0.011 (0.766)		−0.01 (0.795)		−0.007 (0.854)		−0.009 (0.809)		−0.01 (0.793)		−0.001 (0.765)		−0.001 (0.794)		−0.001 (0.853)		−0.001 (0.808)		−0.001 (0.792)	
Constant	−13.937 (0.000)	***	−14.135 (0.000)	***	−14.153 (0.000)	***	−14.229 (0.000)	***	−14.169 (0.000)	***										
Observations	1591		1591		1591		1591		1591											

Notes: This Table reports the probit and marginal effects estimations for CEO turnover for the five different horizons of insider purchases. Columns (1) to (5) report the probit coefficients and columns (6) to (10) report the marginal effects; CPS_1 is a proxy of one year lagged CEO pay disparity, measured as a ratio of the total CEO pay divided by the sum of top five executives pay; ARETs with suffix [60_1 to 180_1] are the lagged average abnormal returns of non-CEO executives for different horizons from 60 to 180-day period, respectively; lnCEOAGE is the natural logarithm of the CEO age in the year t ; lnTENURE, proxies for CEO tenure, is the natural logarithm of the number of years that CEO have taken the position; DUAL is CEO duality, coded 1 when the CEO also held the board chair position, 0 otherwise. The variable ACCRUALS_1 is lagged accruals defined as the difference between earnings and cash flows; OFCPS_1 is the lagged operating cash flow per-share. QRATIO is measured by the Q-ratio of a firm. SIZE_1 is the firm size in year $t - 1$, measured as the natural logarithm of the total market capitalization of a firm. p values are reported in parentheses below the coefficient estimates. The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Our results of ARETs estimations provide supportive evidence for how the presence of a tournament prize influences managerial pay. A negative coefficient on the interaction term of CPS and insider selling returns shows that within-board pay disparity incentivizes the potential replacement of the CEO within the current board. Lower pay disparity may demotivate CEOs to work hard to retain their place, discouraging other executives from competing for promotion. As a result, a lower incentive prize effectively increases other executives' impatience, leading them to seek other income streams earned by exploiting their inside information regarding their firms' poor performance. When this occurs at the same time, as a higher threat of CEO dismissal following poor performance increases, the likelihood of CEO turnover increases.

Our results in Table 5 also provide similar signs, statistical significance, and magnitudes of CEO and firm characteristics as previously reported for the insider purchase sample in Table 4. Positive coefficients on CEO age and tenure suggest firms with older and longer tenure CEOs have a higher likelihood of their CEO departing the firm. A negative coefficient on DUAL implies that firms with CEOs who are also the board chair are less likely to be dismissed than other CEOs. The negative associations between CEO turnover and two other variables, ACCRUALS_1 and OCFPS_1, support our conclusion on the impact of the interaction term.

Overall, the results of our insider sale sample support our hypotheses H4 and H6. The positive relation between insider trading and the probability of CEO turnover suggests that non-CEO executives tend to exploit insider bad news about their firms prior to a CEO's dismissal, whereas the interaction between CEO pay disparity and insider returns provides evidence of pay disparity's role in setting the incentive prize. This implies that firms with a lower CPS demotivate a CEO to remain in the post and lessen the incentives to other executives to compete for the CEO position. The CEO's demotivation may cause a higher probability of CEO exit, while an increase in impatience incentivizes other executives to exploit inside information.

4.3. Further Analysis

First, in order to check whether the pay disparity can cause changes in CEOs, we examine the relationship between turnover and different levels of CPS. We employ the two-sample Kolmogorov–Smirnov test (K-S test) between the top and bottom deciles of CEO tenure lengths ranked by CPS in both buy and sell subsamples. High and low CPS are defined respectively for the top and bottom deciles of CPS at different levels of 10%, 20%, 30% and 40% sample deciles. By employing different two-sample K-S tests at various sample deciles, we found only significantly different means between the 10% upper and bottom CEO tenure length, ranked by CPS for the buy sample. This implies that CEOs in high CPS firms have shorter tenures than those of low CPS firms.

Figure 3 depicts the cumulative distribution of CEO tenure length, conditional upon high and low CPS. The solid line plots the kernel estimate of the distribution for the upper 10% of CEO episodes ranked by CPS, whereas the dashed line corresponds to the bottom 10%. The two-sample Kolmogorov–Smirnov test confirms the visual impression that the two samples are drawn from different distributions. The cumulative distribution for the high CPS subsample is significantly above the distribution for the low CPS sample. This implies that the likelihood of a CEO having a tenure length of less than any number of years is higher for CEOs of firms with a higher CPS than for the CEOs leading firms with low CPS.

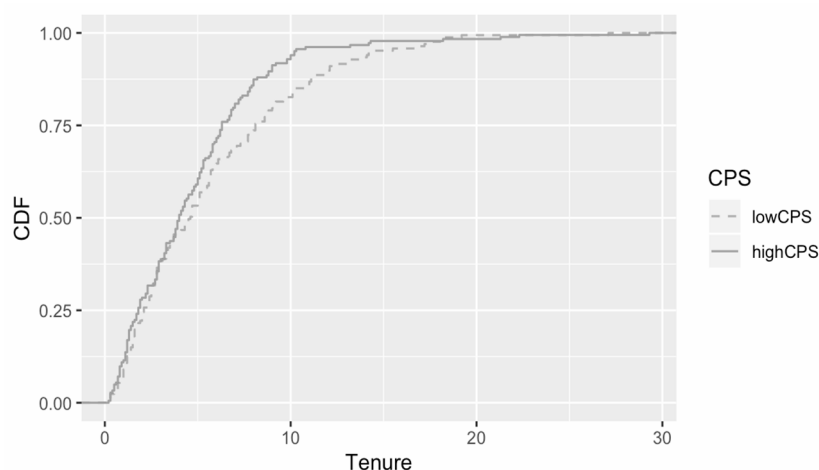


Figure 3. Distribution of CEO tenure conditional on CEO pay disparity (CPS). The Figure depicts the kernel estimate of the empirical cumulative distribution of CEO tenure length (TENURE) for two subsamples conditional on the CEO pay slide. The first subsample (lowCPS) consists of the bottom decile of CEO tenure sorted by CPS; the corresponding distribution is plotted as a dashed/red line. The second subsample (highCPS) consists of the top decile of CEO tenures when sorted by CPS rankings; the corresponding distribution is plotted as a solid line.

Second, we retest our implications by computing probit models, including dummy variables classifying CPS for the buy transactions and age and tenure for both the buy and sell samples. To examine whether the impact of high CPS on CEO turnover is different to that of the low CPS/buy sample, we include a dummy variable called HighCPS. This is coded 1 if the CPS lies in the top 10% decile of the subsample. The dummy variable mid-CPS is defined as the medium CPS, which is coded 1 if CPS lies between 10% of the top and 10% of the bottom deciles within the buy subsample. Low CPS lies in the bottom 10% decile, which acts as a comparator group in the analysis. Voluntary turnover is often presented as retirements induced by poor health or death, while forced turnover occurs when the CEO is forced out of their position or departs due to policy differences. To determine whether the CEO turnover was forced or voluntary, we follow prior studies (see, among others, Jarva et al. 2019) in defining forced turnover if the CEO's age is less than 60 and voluntary if the CEO's age is at or above 60. We also include a dummy variable capturing cute CEO tenure. In order to control for different CEO tenures, we classify the CEOs as old CEOs if their tenure is at or above the sample median and as new CEOs if their tenure is below the sample median.

Results for our buy and sell samples are reported in Tables 6 and 7, respectively. For brevity, we only report the coefficients on the main variables ARETs and CPS and the mentioned additional variables. Table 6 shows the coefficients of insider buying returns ARETs and CEO pay disparity CPS_1 and the interaction between them across the five horizons. These findings are similar to corresponding values documented in Table 4 in terms of both their sign and statistical significance. Similarly, CPS_1 is significantly and negatively associated with CEO turnover, while the significant relations between CEO turnover and insider returns and the interaction terms are recorded for only models (1) and (2). The coefficients on the dummy variable for high CEO pay disparity, HighCPS, are significant and positive at the 10% level for the four models, indicating that CEOs in the firms with high CEO pay disparity are more likely to be dismissed than those in the firms with low pay disparity. The results show further evidence to confirm the previous findings that insider buying returns and CEO pay disparity have a negative impact on CEO turnover. An increase in insider returns may be positively related to CEO turnover when the CEO pay disparity is higher.

Table 6. Insider returns, executive pay disparity and CEO turnover—Additional analysis—buy sample.

	Dependent Variable: CEO Turnover									
	Coefficients (<i>p</i> -Value)					Marginal Effects (<i>p</i> -Value)				
	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CPS_1	−1.004 ** (0.011)	−0.984 ** (0.013)	−0.965 ** (0.014)	−0.972 ** (0.013)	−0.985 ** (0.012)	−0.162 * (0.051)	−0.159 ** (0.011)	−0.157 ** (0.013)	−0.158 ** (0.012)	−0.160 ** (0.011)
ARET60_1	−0.026 * (0.053)					−0.004 ** (0.011)				
INTERACTION60	0.061 ** (0.026)					0.009 ** (0.025)				
ARET90_1		−0.025 ** (0.018)					−0.004 ** (0.016)			
INTERACTION90		0.049 ** (0.023)					0.008 ** (0.022)			
ARET120_1			−0.01 (0.229)					−0.0016 (0.228)		
INTERACTION120			0.019 (0.255)					0.0031 (0.254)		
ARET150_1				−0.01 (0.150)					−0.0016 (0.149)	
INTERACTION150				0.019 (0.157)					0.00309 (0.156)	
ARET180_1					−0.009 (0.123)					−0.001 (0.122)
INTERACTION180					0.02 (0.105)					0.003 (0.103)
HighCPS	0.590 * (0.099)	0.597 * (0.095)	0.589 * (0.099)	0.584 (0.101)	0.588 * (0.100)	0.127 * (0.097)	0.129 * (0.883)	0.128 * (0.087)	0.126 * (0.094)	0.127 * (0.098)
MidCPS	0.117 (0.512)	0.121 (0.501)	0.108 (0.545)	0.109 (0.541)	0.112 (0.532)	0.018 (0.490)	0.018 (0.470)	0.016 (0.520)	0.0169 (0.521)	0.017 (0.51)
AGE60	0.597 *** (0.000)	0.600 *** (0.000)	0.607 *** (0.000)	0.607 *** (0.000)	0.606 *** (0.000)	0.123 *** (0.000)	0.124 *** (0.000)	0.012 *** (0.000)	0.126 *** (0.000)	0.125 *** (0.000)
HighTENURE	0.658 *** (0.000)	0.643 *** (0.000)	0.635 *** (0.000)	0.642 *** (0.000)	0.643 *** (0.000)	0.105 *** (0.000)	0.102 *** (0.000)	0.102 *** (0.000)	0.103 *** (0.000)	0.103 *** (0.000)
CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.409 *** (0.002)	−0.342 *** (0.003)	−0.343 *** (0.003)	−1.338 *** (0.003)	−1.345 *** (0.003)					
Observations	1582	1582	1582	1582	1582					

Notes: This Table reports the probit and marginal effects estimations for CEO turnover for the five different horizons for insider purchases. Columns (1) to (5) report the probit coefficients, and columns (6) to (10) report the marginal effects; CPS_1 is a proxy of one year lagged CPS, measured as a ratio of the total CEO pay divided by the sum of total pay for the top five executives; ARETs with suffix [60_1 to 180_1] are the lagged average abnormal returns of non-CEO executives for different horizons from 60 to 180-day period, respectively; HighCPS is High CEO pay disparity coded 1 if the CPS lies in the top 10% sample deciles. MidCPS is medium CEO pay disparity coded 1 if the CPS lies between the top and bottom 10% of sample deciles. AGE60 is coded 1 if the CEO's age is at or above 60. HighTENURE is coded 1 if the CEO's tenure is at or above the sample median. CONTROLS is a shorthand for other control variables, being coded "Yes"/"No" if the estimations are similar/dissimilar to the main regression results. *p*-values are reported in parentheses below the coefficient estimates. The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The coefficients on the dummy variables AGE60 and HighTENURE provide further evidence that CEOs who are older than 60 with longer tenure have a greater tendency to depart than their younger peers. With regards to CEO age, the results of our sample suggest that the probability of a voluntary CEO turnover (e.g., retirements, poor health or death, etc.) is larger than forced CEO turnover. A positive coefficient on the high tenure dummy variable confirms our findings that a more entrenched CEO with longer tenure has often exposed their weakness to boards, hence increasing the likelihood of dismissal.

Table 7 presents the results for the insider sale subsample of probit and marginal effects estimations with the inclusion of the dummy variables for the CEO's age and tenure. The Table shows results similar to those of the CPS_1, ARETs_1, and control variables reported in Table 5 in terms of both sign and statistical significance. Similar to the results of our buy sample, the coefficients on the dummy variables AGE60 and HighTENURE are significant and positive in relation to the probability of CEO turnover. The results also confirm our findings from the previous section.

Table 7. Insider returns, executive pay disparity and CEO turnover—Additional analysis—sell sample.

	Dependent Variable: CEO Turnover											
	Coefficients					Marginal Effects						
	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]	[0–60]	[0–90]	[0–120]	[0–150]	[0–180]		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		
CPS_1	−0.003 (0.182)	−0.003 (0.200)	−0.003 (0.164)	−0.003 (0.161)	−0.003 (0.152)	−0.0004 (0.180)	−0.0004 (0.198)	0.0005 (0.167)	−0.0005 (0.158)	−0.0005 (0.15)		
ARET60_1	0.036 (0.019)	**				0.006 (0.017)	**					
INTERACTION60	−0.001 (0.014)	**				−0.0001 (0.0126)	**					
ARET90_1		0.029 (0.009)	***				0.0048 (0.008)	***				
INTERACTION90		−0.001 (0.007)	***				−0.0001 (0.006)	***				
ARET120_1			0.016 (0.031)	**				0.0027 (0.036)	**			
INTERACTION120			−0.0004 (0.024)	**				0.0002 (0.0239)	**			
ARET150_1				0.013 (0.047)	**				0.0021 (0.046)	**		
INTERACTION150				−0.0003 (0.061)	*				−0.0004 (0.059)	*		
ARET180_1					0.010 (0.080)	*				0.0016 (0.079)		
INTERACTION180					−0.0002 (0.102)					0.0015 (0.102)		
AGE60	0.602 (0.000)	***	0.607 (0.000)	***	0.603 (0.00)	***	0.606 (0.000)	***	0.126 (0.000)	***	0.127 (0.000)	***
HighTENURE	0.660 (0.000)	***	0.653 (0.000)	***	0.655 (0.000)	***	0.661 (0.000)	***	0.0107 (0.000)	***	0.106 (0.000)	***
CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−1.554 (0.000)	***	−1.574 (0.000)	***	−1.582 (0.000)	***	−1.564 (0.000)	***	−1.548 (0.000)	***		
Observations	1591	1591	1591	1591	1591	1591						

Notes: This Table reports the probit and marginal effects estimations for CEO turnover for the five different event windows of insider purchases. Columns (1) to (5) report the probit coefficients, and columns (6) to (10) report the marginal effects; CPS_1 is a proxy of one year lagged CEO pay disparity, measured as a ratio of the total CEO pay divided by the total pay of the top five executives; ARETs with suffix [60_1 to 180_1] are the lagged average abnormal returns of non-CEO executives for different event windows from 60 to 180-day period, respectively; HighCPS is High CEO pay disparity coded 1 if the CPS lies in the top 10% sample deciles. MidCPS is medium CEO pay disparity coded 1 if the CPS lies between the top and bottom 10% of sample deciles. AGE60 is coded 1 if the CEO's age is at or above 60. HighTENURE is coded 1 if the CEO's tenure is at or above the sample median. CONTROLS is shorthand for other control variables, coded "Yes"/"No" if the estimations are similar/dissimilar to the main regression results. *p*-values are reported in parentheses below the coefficient estimates. The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

5. Conclusions

This paper discusses the impact of CEO pay disparity and insider trading on CEO turnover, focusing on turnover driven by either managerial power or tournament incentives. The findings presented in this study contribute significantly to enhancing its overall persuasiveness. Under the managerial power theory, the pay disparity between CEO and non-CEO executives reflects the CEO's power to influence the pay-setting process and obstruct/frustrate effective CEO succession planning in order to maintain his position. Under tournament theory, the CEO pay disparity represents a huge incentive for other executives who compete for the CEO position, thereby increasing the likelihood of CEO turnover in favour of a rival within the board. The assumption is that non-CEO executives in firms with excessive managerial power in setting CEO pay tend to have greater returns from insider stock purchases. However, these executives in firms with high CEO pay disparity, reflecting an attractive tournament prize, are more likely to earn higher returns from their stock sales.

Using a dataset of the firms listed on eight major indices of the most developed markets over an eleven-year period, we provide compelling evidence on the relation between the insider returns of non-CEO executives and the probability of CEO dismissal and the consequent impact of the CEO pay gap on this relationship. Our findings highlight several key insights.

First, in the insider purchases sample, we establish a close linkage between CEO turnover and the pay disparity between the CEO and other executives in the top management team. Notably, in the insider purchase sample, CEOs in firms with a large pay disparity exhibit a reduced likelihood of being dismissed. However, in the insider sales sample, we find no significant relationship between the managerial pay gap and turnover.

Second, our analysis reveals that an increase in insider purchase returns serves as a credible signal of CEO entrenchment. Conversely, an increase in insider selling returns among non-CEO executives acts as a credible signal for an impending CEO departure.

Furthermore, we uncover interesting results when examining the coefficients on the interaction term of CEO pay disparity and non-CEO executive returns. Although *insider buying returns* individually exhibit a negative association with CEO turnover, an increase in these returns, coupled with a positive effect on CEO pay, may worsen the firm's prospects, thereby increasing the likelihood of CEO dismissal. In addition, lower pay disparity can lead to the CEO's demotivation to remain and lessen the incentives of other executives to compete in the tournament, thereby encouraging them to seek out other incomes by exploiting inside information.

We believe that our study is the first to provide empirical evidence on the association between the probability of CEO turnover and insider returns of non-CEO executives. Furthermore, we demonstrate a significant impact of the interaction between the CEO pay gap and insider returns on the likelihood of CEO turnover. By elucidating the determinants of CEO turnover, a key variable in corporate finance and firms' managerial decisions, our research enriches the existing body of knowledge in the field. Importantly, our results remain robust even after controlling for the influence of the CEO characteristics often considered the most relevant to CEO turnover.

From a policy perspective, our study underscores the importance of transparent compensation practices and effective board oversight in mitigating CEO entrenchment and ensuring alignment with shareholder interests. Policymakers should consider regulations that promote equitable pay structures and accountability mechanisms, which can ultimately enhance organizational performance and stakeholder confidence. Additionally, organizations should cultivate a culture of open communication and fair competition to encourage talented executives to remain within the company while also addressing potential conflicts of interest that may arise from insider trading practices.

While our findings offer significant contributions, several limitations should be acknowledged. The reliance on data from developed markets may restrict the generalizability of our results to emerging markets with different corporate governance structures and cultural contexts. Future research should aim to explore these dynamics across diverse regulatory environments to enhance the applicability of our conclusions.

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Article

Pension Risk and the Sustainable Cost of Capital

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Abstract: Prior research empirically finds that the systematic equity risk for US firms as measured by beta reflects the risk of their defined benefit pension plans, despite opaque and complicated pension accounting rules. This paper re-examines this question in the context of subsequent clarification of these rules, and the growing importance of non-defined benefit pension funds. This issue is examined by comparing standard equity-based models with a broader pre-existing shareholder model of the reporting entity to re-examine the relationship between firm equity risk and pension plan risk. The empirical tests are conducted on a sample of S&P 500 firms during the first three years of the introduction of the revised pension accounting rules (2006–2008), based on panel data regression relating firm risk to pension risk and controlling for other variables. In contrast to the prior findings of JMB, the estimated cost of capital is additionally sensitive to the following: (a) alternative explicit versus implicit definitions of pension liability; (b) the nature and scope of long-term deferred compensation arrangements; and (c) the scope and nature of investment-related risks through investment in sponsoring company stock that are associated with these pension arrangements.

Keywords: pension plans; cost of capital; equity risk

JEL Classification: J23; M41s

1. Introduction

Jin et al. (2006, hereinafter, JMB) find that pension risk is priced despite arcane financial reporting for pensions. They assume that pension risk is entirely reflected in the systematic risk of pension plan sponsoring firms (as measured by beta from the capital asset pricing model (CAPM)), although they acknowledge examining the broader relation of pension risk to ‘idiosyncratic risk, or total risk may be of interest’ (p. 2). This paper extends JMB’s research in several ways besides integrating the extended pension arrangements into the firm. First, it re-estimates the cost of capital, by using more detailed pension asset allocation decomposition than that reported in JMB, as well as data on longevity risk and credit risk, using data drawn from annually published industry sources. It also further decomposes the pension liability beta to reflect the underlying demographics of the maturity profile of the scheme liabilities. These can be important since simulation studies show that pension assets and liabilities are extremely sensitive to even minor variations in these assumptions (Selling and Stickney 1986; Winkelvoss 1993). Furthermore, the definition of operating assets is more explicit than JMB, and consistent with that of the prior empirical results reported in the relevant financial analysis literature.¹

Moreover, understanding the financial dimensions and long-term sustainability of relations between firms and their employees is increasingly recognized by public policy makers and standard setters.² Human capital is the measure of the economic value that an employee provides, through their knowledge, skills, and abilities.³ However an important implication of reporting the full financial dimensions of these relations under a sustainability reporting framework is their implications for the economic scope of the consolidation, and the sensitivity of the cost of capital estimates to alternative definitions of the scope of the reporting entity (Callahan et al. 2012). However, despite the material impact of

corporate failure on implicit contractual promises made to employees (Tinker and Ghicas 1992), the broader dilution impact of divestitures and investments in implicit contracts on outsider investor interests has received little attention (Zambon and Zan 2000). Moreover, the broader valuation dilution impact of divestitures and investments in implicit contracts on employee wealth on outsider investor interests has received little attention. Landsman and Penman (2007) demonstrate that, under the existing entity theory of accounting, by corporations whereby employer own stock investments, employee stock options, pension funds, and other post-retirement investments are not recognized. By contrast, under an alternative proprietorship theory perspective, passive individual investors collectively control management by holding them accountable for profit, where debt and equity are sharply antagonistic, so that the 'business does not stand in the same relation to its proprietors or its capitalists as to its 'other liabilities' (Sprague 1907, p. 57).⁴

However, such divestitures as part of equity consideration are currently not fully accounted for (Forker 2000). Indeed, recently the Urgent Issues Task Force (2010, guidance 38) proposed that the outside equity diluting effects of all divestitures in company stock should be fully accounted for and that all employee-related benefits with significant levels of own stock investments should be deducted in calculating shareholder equity. Nevertheless, current US GAAP and IFRS continue to apply the entity theory perspective; so that such transactions are ignored.

This paper defines a 'sustainable' cost of capital as existing where relevant entities have sufficient finance when needed to make it possible to maintain long-term, demographically sensitive, and implicit contractual relations with their employees, at their current quality and intensity. This is to be contrasted with a standard procedure which accounts for neither the long-term nature of the relationship nor the equity diluting effect of employee ownership of company own stock. The purpose of this paper is to take a proprietary theory to estimate the diluting impact of significant and material investments and divestitures of company own stock by employee pension and post-retirement and stock ownership trusts in the equity of US firms, and to consider their implications for estimating a long-term sustainable cost of capital for such entities. Forker (2000) argues that a distinguishing feature of the alternative pre-existing equity model of the reporting entity (hereinafter 'PEEM') is that the interests of pre-existing shareholders are identified with that of the business entity.⁵

Existing evidence suggests that the PEEM is more informative than the EM to investors evaluating employee stock options. Landsman et al. (2006) show that employee stock options measured under the PEEM are more value relevant to investors than under existing US GAAP, which implicitly assumes the EM. However, their study is restricted to only examining short-term equity-based compensation and therefore does not consider the valuation implications of longer-term employee compensation arrangements. Currently, US GAAP and IFRS treat these elements separately by expensing the former, but not the latter. Arguably, this has led to an overstatement of profits and incentives for management to manipulate earnings (Picconi 2006).

This inconsistent treatment of equity-based employee compensation does not adhere to the principles of clean surplus accounting and instead proposes the pre-existing equity model (Forker 2000). Forker (2000) identifies PEEM as being superior to EM in providing useful information when accounting for employee benefits. This also has important implications for analyzing the impact of firm-specific risks related to long-term employment compensation arrangements and the sponsoring firms' cost of capital. Although finance theory suggests that only non-diversifiable risks are awarded and firms' idiosyncratic risks do not affect investors' expected returns or firms' cost of capital, there is growing evidence concerning the impact of idiosyncratic risk in explaining cross-sectional expected returns (e.g., Malkiel and Xu 2002; Brockman et al. 2009). Practitioner-oriented textbooks (e.g., Brealey et al. 2006; Pratt et al. 2014) also argue that investors' concerns about lack of diversification, insider stock ownership, liquidity, financial distress, and management incentives

cause stock markets to price firm-specific risk. However, these textbooks fail to mention the relationship between pension risk and firm risk in estimating the cost of capital.

However, the existing literature provides little guidance as to how such factors can affect a firms' cost of capital. This paper explores the effect of firm-specific risks, in particular, pension-related risks, on firms' cost of capital from a PEEM perspective. This is important where employees hold material investment in companies' own stocks, whether explicitly in the form of stock options, or implicitly through the delegated ownership of company stock through participation in company sponsored 401K, investment trusts, health care plans, or defined benefit plans due to lack of diversification or liquidity.⁶ Research shows that this kind of idiosyncratic risk has impact on firms' cost of capital. For example, Himmelberg et al. (2002) find a positive association between the concentration of inside ownership and the cost of capital, even in countries with relatively high degrees of investor protection such as the UK and the US.⁷

During the financial crisis of 2007–2009, the combination of declining stock prices and lower interest rates has attracted substantial attention on the nature and magnitude of firms' exposure to pension fund commitments to their employees, and in particular, the declining significance of defined benefit pension funds relative to non-defined pension and post-retirement benefits.⁸ At the same time, financial markets experience difficulties in valuing even just the defined benefit pension promises made by firms. Coronado and Sharpe (2003) and Coronado et al. (2008) find that stock prices of S&P 500 companies providing defined benefit pension plans were generally misvalued over their sample periods, while others (Picconi 2006; Hann et al. 2007; Franzoni and Marin 2006) suggest that opaque accounting has caused firms to be undervalued relative to overfunded pension plans.

In contrast, the analysis also disentangles the proportion of 'enterprise value' belonging to the firm's sub-group of external, diversified stockholders from its separate sub-group of mostly undiversified, employee stockholders. On the one hand, equity interests of outside investors may be severely diluted by employees who hold company stocks; on the other hand, employees are undiversified investors and expose themselves to firm-specific risk through participation in 401K plans. For the purposes of presentation, this paper delineates any post-retirement benefit arrangement other than defined benefits plans (DB), including 401K plans, defined contribution plans, health care plans, stock option plans, and saving plans, which involve significant or material investment in company own stock by employee participants in these schemes, who thereby become undiversified investors, the combined impact of which is labeled 'NDB'-related plans for simplicity. NDB plans are thus a significant source of pension-related sources of idiosyncratic risk of the sponsoring firm and can be very significant for firms that curtail their DB plans, as disclosed in the pension footnotes.

While JMB identify the value and risk errors of not consolidating the DB plans, the analysis in this paper develops this insight further by integrating NDB plans, as forms of idiosyncratic risk which affect the equity claims of existing shareholders.⁹ This paper characterizes these NDB and DB arrangements as either as segregated insurance contracts or as fully consolidated sources of retirement income risk capital. These alternative treatments have important debt–equity mix implications since these exposures can either be fully merged with the firm as an insurance subsidiary or consolidated into the firm as an equity 'company own stock' investment activity by undiversified NDB plans, thus effectively diluting the interests of outside equity holders.

In contrast to the entire population of US firms as the basis for the analysis undertaken by Jin et al. (2006), this paper also contributes by estimating the cost of capital for a sample of large US S&P 500 firms under various scenarios where material changes in pension related Generally Accepted Accounting Principles (GAAP) can occur. The estimated cost of capital is found to be sensitive to the following: (a) alternative pension GAAP; (b) whether a firm's pension exposure is classified primarily as a debt or equity instrument; and (c) the scope and nature of the pension plans being consolidated with the firm. Consolidating the defined benefit pension fund into the broader set of deferred compensation arrangements

between employees and the firm significantly and materially alters the debt and equity composition of the firm. This results in a significantly higher cost of capital estimates than those reported by JMB. In contrast to JMB, the relationship between a firm's systematic risk and pension risk is not statistically significant. Identifying the relationship between firm and pension risk that is associated with a broader set of deferred compensation arrangements, such as underfunded health care plans and company own stock investments of 401K and defined contribution plans, increases the strength of association with firm risk, particularly for the sub-set of firms which terminated their defined benefit arrangements.¹⁰ Finally, the cross-section of returns is explained incrementally by the degree of idiosyncratic risk exposure, especially for firms with significant levels of pension under-funding.

The remainder of this paper is as follows: Section 2 outlines the prior literature and the proposed model; Section 3 describes the sample and data; Section 4 reports the baseline empirical results; Section 5 reports robustness tests; Section 6 concludes.

2. Review of Literature and Proposed Model

Forker (2000) argues that choosing a model of the reporting entity (MRE) for the purpose of measuring profit is important for both conceptual and practical reasons, particularly in the context of accounting for equity-based consideration (EBC), and identifies three main MREs:

- In Paton's (1922) 'All-Equities' model (AEM), the balance sheet equation is assets = equities. The boundary of the residual entity includes all financial instruments and there is no distinction, for the purpose of measuring income, between equity and liability financing. Interest, dividends, and wealth transfers between 'equities' are accounted for as appropriations of income and the method of financing EBC has no impact on income. This model is considered to be outdated as it ignores the effect of financing.
- The equity model (EM) is based on the assets less liabilities = equity equation, where equity is defined to include all equity instruments including EBC financed by the issue of new shares. This is the standard model of equity which currently underlies GAAP in many countries and internationally under international financial reporting standards.
- The pre-existing equity model (PEEM) is also based on the assets less liability equals equity relationship, but the residual entity is more narrowly defined to include only the rights of the pre-existing equity. In the PEEM, the full cost of equity-based consideration payable to employees is recognized as an expense irrespective of whether it is funded by cash or equity or a mixture of the two. Thus, compared to existing GAAP practices in accordance with EM, periodic income and return on capital employed is lower in the PEEM and reflects the change in the wealth of pre-existing shareholders in the firm.

A major motivation for this analysis is doubts expressed by the relevant prior literature (e.g., Forker 2000) over the validity of the EM as a valid basis for recognizing long-term implicit equity-based employee compensation components, which is the maintained assumption underlying prior research. This study, therefore, reexamines the JMB analysis of the relationship of pension value and risk to firm systematic risk that is premised on the EM, with the PEEM.

This in turn has implications for identifying the appropriate measure of pension obligations that should be recognized by employer sponsors (i.e., accumulated benefit obligation (ABO), or the projected benefit obligation (PBO) under these alternative models of the reporting entity, which are briefly outlined below.

(i) Accumulated benefit obligation (ABO). The pension liability is estimated without incorporating any assumptions about the future growth of the obligations defined in terms of accrued benefit obligations. It was formerly required under US GAAP SFAS 87 (FASB 1985, 2003), before the introduction of SFAS 158 (FASB 2006). It is also consistent with an all-equities model (hereinafter AEM), since changes are netted as a surplus or deficit and no distinction is made between debt and equity components of pension arrangements. It

was previously required to be recognized in financial statements, but only if underfunded (Jin et al. 2006, p. 10). In other words, firms were not required to report the full ABO prior to 2006. In measuring pension risk, JMB uses the Form 5500 pension asset categorization to identify pension asset risk and acknowledge that they are only able to use the average risk level for each broader asset class. We consider the allocation of pension assets at a more detailed level than reported under the Form 5500 data. The detailed pension asset allocation data is expected to lead to higher accuracy in estimating pension asset beta.¹¹

(ii) Projected benefit obligation (PBO). This pension liability incorporates allowances for salary growth, as set out under new pension accounting rules SFAS 158, effective for reporting periods ending on or after 15 December 2006, which is the basis of this study. Barth (1991) shows evidence that capital markets place greater weight on the projected benefit obligation, which incorporates future salary growth assumptions. This measure of the pension obligation is consistent with the EM, since all intra-equity transfers are netted as a surplus or deficit, but price changes on liabilities are recognized on the comprehensive income statement.

This paper specifically focuses on the distinctions between alternative MRE and their implications to help financial analysts and regulators to better understand the relationship between a sponsoring firm's capital structure and that of its sponsored DB and NDB plans, under alternative AEM, EM, and PEEM models of the corporate reporting entity which has material exposure to such employee benefit obligations. A comparison of the characteristics of different models of the reporting entity and their implications for the appropriate treatment of equity-based employee consideration is provided in Table 1.¹²

Table 1. Comparison of models of the reporting entity (MRE).

Characteristic	All-Equities Model (AEM)	Equity Model (EM)	Pre-Existing Equity Model (PEEM)
Boundary of the model of the reporting entity (MRE)	All funding instruments	Equity instruments, including rights to contingently issuable shares	Existing equity shareholders
Income measurement and capital structure	No distinction between debt and equity	Debt and equity separately classified	All funding instruments, except existing equity classified as liabilities
Accounting for wealth transfers within the boundary of the MRE	All transfers are netted with zero impact on income	Intra-equity transfers are netted, but price changes on liabilities are recognized in the income statement	All wealth transfers are recognized in the income statement
Clean surplus accounting	No	Yes, for liability instruments. No for equity instruments	Yes
Accounting for employee stock options, share of DB and DC, and 401K equity investments in own firm	Yes, for DB only (assume 'surplus' = ABO – MV of pension assets); no unexpected variations affect income	Yes, for DB (assume 'surplus' = ABO – MV pension assets); no for DC or 401K employee ownership of company own stock	Yes, for DB (assume 'surplus' = PBO – MV pension assets); yes, for DC or 401K employee ownership of company own stock as liabilities

We define NOA as the value of net operating assets, NFL as the net financial liabilities, PA_{DB} as the value of pension asset for a DB plan, PA_{NDB} as the value of pension asset for a NDB plan, PL_{DB} as the value of pension liability for the DB plan, PL_{DB} as the pension liability value of the DB plan, and PL_{NDB} as the liability value of NDB plans. Although NDB plans in theory cover any form of post-retirement benefit arrangement, due to the lack of availability of publicly available data, PL_{NDB} is defined to cover 401k plans, post-retirement unfunded health care benefits subject to the disclosure requirements of SFAS 106, and other forms of publicly disclosed DC plan.

Taking account of employees' interest in company stock as equity investments to be eliminated upon consolidation, we also discriminate between E_{CE} as the value of

common equity (outsider shareholders) and, E_{EE} as the value of employee equity (employee shareholders). Note OPT pension plan-related options, including PBGC and employer's call option, on net pension fund worth.

Similar to JMB, we consider cases without taxes. The economic balance sheet can be written as:

$$NOA + PA_{DB} + PA_{NDB} + OPT = NFL + PL_{DB} + PL_{NDB} + E_{CE} + E_{EE} \quad (1)$$

$$\text{Denoting } NPL_{DB} = PL_{DB} - PA_{DB} = NPA_{DB},$$

$$NPL_{NDB} = PL_{NDB} - PA_{NDB} = NPA_{NDB}, \text{ and}$$

$$E = E_{CE} + E_{EE}.$$

Thus, under the consolidated approach, E, equity of the firm is segregated into two components: common equity of the firm, E_{CE} , and equity of employer securities, E_{EE} , the equity invested by the firm's sponsoring pension plans (both DB and NDB pension plan assets).

Systematic risk or beta of operating asset, B_{NOA} when both the pension value and pension risk are correctly considered, is

$$\beta_{NOA} = \frac{E}{NOA} \beta_E + \frac{NFL}{NOA} \beta_{NFL} - \left(\frac{PA_{DB}}{NOA} \beta_{PA_{DB}} - \frac{PL_{DB}}{NOA} \beta_{PL_{DB}} \right) - \left(\frac{PA_{NDB}}{NOA} \beta_{PA_{NDB}} - \frac{PL_{NDB}}{NOA} \beta_{PL_{NDB}} \right) - \frac{OPT}{NOA} \beta_{OPT} \quad (2)$$

Error case 1: The calculation of operating asset risk ignores both DB and NDB pension plans, including their values and risks. The estimated operating asset beta becomes

$$\widehat{\beta}_{NOA} = \frac{E}{NOA} \beta_E + \frac{NFL}{NOA} \beta_{NFL} - \frac{OPT}{NOA} \beta_{OPT} \quad (3)$$

The resulting estimation specification error, defined as $\hat{\epsilon}_{NOA} = \hat{\beta}_{NOA} - \beta_{NOA}$, is

$$\hat{\epsilon}_{NOA} = \frac{PA_{DB}}{\widehat{NOA}} (\beta_{PA_{DB}} - \beta_{PL_{DB}}) + \frac{PA_{NDB}}{\widehat{NOA}} (\beta_{PA_{NDB}} - \beta_{PL_{NDB}}) - \frac{NPA_{DB}}{\widehat{NOA}} (\beta_{NOA} - \beta_{PL_{DB}}) - \frac{NPA_{NDB}}{\widehat{NOA}} (\beta_{NOA} - \beta_{PL_{NDB}}) \quad (4)$$

where $\widehat{NOA} = NOA + NPA_{DB} + NPA_{NDB}$.

Proof. See Appendix A. $\square$

Without considering the NDB plan, this expression of difference between "true" and estimated systematic risks of operating assets is the same as that in JMB. For both DB and NDB plans, it is usually true that: $\beta_{PA} \geq \beta_{PL}$ and $\beta_{NOA} \geq \beta_{PL}$. Therefore, if both DB and NDB pension surpluses are not large, then $\hat{\epsilon}_{NOA} > 0$ or $\beta_{NOA} < \hat{\beta}_{NOA}$ i.e., the specification error on the estimation of the operating asset beta generally leads to an upward bias. If both DB and NDB pension funds are in balance, $NPA = 0$, or if $NPA_{DB} = 0$, then $NPA_{NDB} < PA_{DB} \frac{(\beta_{PA_{DB}} - \beta_{PL_{DB}})}{(\beta_{NOA} - \beta_{PL_{NDB}})} + PA_{NDB} \frac{(\beta_{PA_{NDB}} - \beta_{PL_{NDB}})}{(\beta_{NOA} - \beta_{PL_{NDB}})}$ or, if $NPA_{NDB} = 0$, and $NPA_{DB} < PA_{DB} \frac{(\beta_{PA_{DB}} - \beta_{PL_{DB}})}{(\beta_{NOA} - \beta_{PL_{DB}})} + PA_{NDB} \frac{(\beta_{PA_{NDB}} - \beta_{PL_{NDB}})}{(\beta_{NOA} - \beta_{PL_{DB}})}$, then $\beta_{NOA} < \hat{\beta}_{NOA}$ holds.

Error case 2: The calculation of operating asset risk includes both pension values, but inappropriately assumes the associated risks for both pension plans. If, for example, both DB and NDB pension asset and pension liability risks are assumed to be the same and equal to the risk of the debt of the firm, $\hat{\beta}_{PA} = \hat{\beta}_{PL} = \beta_{NFL}$, then the estimated operating asset beta becomes

$$\hat{\beta}_{NOA} = \frac{E}{NOA} \beta_E + \frac{NFL - NPA_{DB} - NPA_{NDB}}{NOA} \beta_{NFL} - \frac{OPT}{NOA} \beta_{OPT} \quad (5)$$

The specification error in the estimated beta is given by

$$\hat{\varepsilon}_{NOA} = \frac{PL_{DB}}{NOA}(\beta_{NFL} - \beta_{PL_{DB}}) + \frac{PA_{DB}}{NOA}(\beta_{PA_{DB}} - \beta_{NFL}) + \frac{PL_{NDB}}{NOA}(\beta_{NFL} - \beta_{PL_{NDB}}) + \frac{PA_{NDB}}{NOA}(\beta_{PA_{NDB}} - \beta_{NFL}) \quad (6)$$

Proof of Equation (6). If both the value and the risk of the pension plans, including DB and NDB plans, are ignored, then the estimated operating asset is

$$\widehat{NOA} = E + NFL - OPT = NOA + NPA_{DB} + NPA_{NDB}$$

The estimated operating asset beta becomes

$$\hat{\beta}_{NOA} = \frac{E}{\widehat{NOA}}\beta_E + \frac{NFL}{\widehat{NOA}}\beta_{NFL} - \frac{OPT}{\widehat{NOA}}\beta_{OPT}$$

Define $\widehat{NOA} = NOA + NPA_{DB} + NPA_{NDB}$.

Note that $\widehat{NOA} = NOA + NPA_{DB} + NPA_{NDB}$.

The weighted average betas of NPA and $\widehat{NOA}$ are given by:

$$\beta_{NPA} = \frac{PA}{NPA}\beta_{PA} - \frac{PL}{NPA}\beta_{PL}$$

and

$$\begin{aligned} \hat{\beta}_{NOA} &= \frac{NOA}{NOA + NPA_{DB} + NPA_{NDB}}\beta_{NOA} + \frac{NPA_{DB}}{NOA + NPA_{DB} + NPA_{NDB}}\beta_{NPA_{DB}} \\ &\quad + \frac{NPA_{NDB}}{NOA + NPA_{DB} + NPA_{NDB}}\beta_{NPA_{NDB}} \\ &= \beta_{NOA} + \frac{NPA_{DB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{NPA_{DB}} - \beta_{NPA_{NDB}}) + \frac{NPA_{NDB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{NPA_{NDB}} - \beta_{NOA}) \\ &= \beta_{NOA} + \frac{NPA_{DB}}{NOA + NPA_{DB} + NPA_{NDB}}\left(\frac{PA_{DB}}{NPA_{DB}}\beta_{PA_{DB}} - \frac{PL_{DB}}{NPA_{NDB}}\beta_{PL_{DB}} - \beta_{NOA}\right) \\ &\quad + \frac{NPA_{NDB}}{NOA + NPA_{DB} + NPA_{NDB}}\left(\frac{PA_{NDB}}{NPA_{NDB}}\beta_{PA_{NDB}} - \frac{PL_{NDB}}{NPA_{NDB}}\beta_{PL_{NDB}} - \beta_{NOA}\right) \\ &= \beta_{NOA} + \frac{PA_{DB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{PA_{DB}} - \beta_{PL_{DB}}) - \frac{NPA_{DB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{NOA} - \beta_{PL_{DB}}) \\ &\quad + \frac{PA_{NDB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{PA_{NDB}} - \beta_{PL_{NDB}}) - \frac{NPA_{NDB}}{NOA + NPA_{DB} + NPA_{NDB}}(\beta_{NOA} - \beta_{PL_{NDB}}) \\ \hat{\varepsilon}_{OA} &= \frac{PA_{DB}}{\widehat{NOA}}(\beta_{PA_{DB}} - \beta_{PL_{DB}}) + \frac{PA_{NDB}}{\widehat{NOA}}(\beta_{PA_{NDB}} - \beta_{PL_{NDB}}) - \frac{NPA_{DB}}{\widehat{NOA}}(\beta_{NOA} - \beta_{PL_{DB}}) - \frac{NPA_{NDB}}{\widehat{NOA}}(\beta_{NOA} - \beta_{PL_{NDB}}) \end{aligned}$$

□

As JMB point out that usually the risk level of pension liabilities and firm debt are similar with normal leverage ratios, i.e., $\beta_{PL} \approx \beta_{NFL}$, but the portion of pension assets that are invested in equities has significantly higher beta risk than the firm debt, i.e., $\beta_{PA} > \beta_{NFL}$. Therefore, it generally holds that $\hat{\beta}_{NOA} > \beta_{NOA}$. Again, operating asset beta is biased upward when both pension fund risks are assumed to be the same as firm's liability risk.

In terms of the implicit contracting theory, JMB's model is adjusted as follows. Note that

$$NOA + PA_{DB} + PA_{NDB} - (PL_{DB} + PL_{NDB}) + OPT = NFL + E,$$

or

$$NOA + PA_{DB} + (PA_{NDB} - E_{EE}) - (PL_{DB} + PL_{NDB}) + OPT = NFL + E_{CE},$$

and both DB and NDB net pension plan risks are separately 'consolidated' into the firms' accounts, where $E = E_{CE} + E_{EE}$. Note that

$$\beta_{E+NFL} = \frac{E}{E + NFL}\beta_E + \frac{NFL}{E + NFL}\beta_{NFL}$$

$$\beta_{ECE+NFL} = \frac{E_{CE}}{E_{CE} + NFL} \beta_{ECE} + \frac{NFL}{E_{CE} + NFL} \beta_{NFL}$$

Therefore, β_{E+NFL} can be rewritten as

$$\beta_{E+NFL} = \beta_{DB1} + \beta_{NDB} + \frac{NOA}{E + NFL} \beta_{NOA} + \frac{OPT}{E + NFL} \beta_{OPT} \quad (7)$$

where

$$\begin{aligned} \beta_{DB} &= \left(\frac{PA_{DB}}{E + NFL} \beta_{PA_{DB}} - \frac{PL_{DB}}{E + NFL} \beta_{PL_{DB}} \right) \\ \beta_{NDB} &= \left(\frac{PA_{NDB}}{E + NFL} \beta_{PA_{NDB}} - \frac{PL_{NDB}}{E + NFL} \beta_{PL_{NDB}} \right) \end{aligned}$$

Similarly, $\beta_{ECE+NFL}$ can be rewritten as

$$\beta_{ECE+NFL} = \beta_{DB} + \beta_{DCE} + \frac{NOA}{E_{CE} + NFL} \beta_{NOA} + \frac{OPT}{E_{CE} + NFL} \beta_{OPT} \quad (8)$$

where

$$\begin{aligned} \beta_{DCE} &= \left(\frac{PA_{NDBE}}{E_{CE} + NFL} \beta_{PA_{DCE}} - \frac{PL_{DB}}{E_{CE} + NFL} \beta_{PL_{NDB}} \right) \\ \beta_{NDB} &= \left(\frac{PA_{NDB}}{E + NFL} \beta_{PA_{NDB}} - \frac{PL_{NDB}}{E + NFL} \beta_{PL_{NDB}} \right) \end{aligned}$$

$PA_{NDBE} = PA_{NDB} - E_{EE}$, and $\beta_{PA_{DCE}}$ is the systematic risk of PA_{NDBE} .

By considering a merged case of pension risk, we can assign a single coefficient b in the regression, assuming that the degree of sensitivity of firm risk to DB pension plan and NDB pension plan is the same. On the other hand, in the separate risk view, one can differentiate sources of pension risk between DB and NDB.

One can use the relationships in Equations (7) and (8) to test whether the beta risk of pension is incorporated in the risk of the firm's capital structure as below:

$$\beta_{E+NFL} = a_1 + b_1 \beta_{pension1} + \varepsilon \quad (9)$$

$$\beta_{ECE+NFL} = a_2 + b_2 \beta_{pension2} + \varepsilon' \quad (10)$$

where $\beta_{pension1} = \beta_{DB1} + \beta_{NDB}$ and $\beta_{pension2} = \beta_{DB2} + \beta_{DCE}$.

In these regressions, b represents the sensitivity of firm risk to firm pension risks and intercept a represents the part of the expected firm risk that cannot be captured by the pension risks. A number of instrumental variables are used to pick up the effect of the intercept and are *expected* to be positive.

3. Sample and Data

The sample is based on the S&P 500 firms that (1) are in continuous existence in the index for the study period from 1 January 2006 to 31 December 2008; (2) have all available stock price in CRSP and financial information on Compustat; and (3) have complete DB and NDB plan asset allocation information reported in the relevant Money Market Directory publication and finally provided sufficient data to complete analysis of their pension risk and value in the period from the date the relevant balance sheet recognition requirements of SFAS 158 for pension assets and liabilities became fully effective, i.e., for reporting periods ending after 15 December 2008. Financial firms are also excluded. This resulted in a final sample of 150 firms. These comprise sample firms based on the majority of SIC code categories, including mining and construction (12), transportation and utilities (32), manufacturing (87), trade (11), and other services (8).¹³

3.1. Sample and Data Collection Procedures

Data for this study were collected from a variety of sources. Stock price and return data were captured from the merged CRSP and Compustat file. Compustat was also used

to capture the main DB pension variables: ABO, PBO, and market value of pension assets. The Money Market Directory was the source of data for detailed asset allocation. The Ratings Direct service of Standard & Poor provided the credit rating history.

3.2. Data Description

Table 2 reports the descriptive statistics for the sample firms. It reports selected company balance sheet information separately by type of pension liability used. To be included in the final sample, Compustat has complete financial and pension data related to the sample of S&P 500 firms for the entire study period with fiscal years ending from 2006 to 2008. The descriptive statistics show that the book value of equity is sensitive to the measurement of pension liability used.

Table 2. Descriptive statistics: selected company balance sheet information. (Standard deviations statistics in brackets).

Variable	No	Mean	Std Dev	25%	Median	75%
DB PA	450	3967	7912	484	1517	3584
PFL1	450	3925	7051	508	1627	3834
PFL2	450	4290	7582	582	1758	4116
NDBPA	450	2225	3264	420	1115	2500
NDBPL	450	1730	2831	270	715	1713
MVE	450	22,336	32,726	5174	11,326	24,945
BVE1	450	8655	13,211	1997	4620	9806
BVE2	450	8432	13,228	1933	4460	9571
NFL	450	3797	8095	328	2056	5513
Put	450	957	2653	0	51	497
Call	450	1004	2932	0	99	629
Employee eEquity	450	441	771	0	139	470

Pension assets, pension liability, and market cap information are obtained from Compustat. Figures are in millions of dollars. The sample is 150 S&P 500 firms. Data are pooled for 2006–2008. Pension asset DB is the market value of pension assets in the defined benefit fund. PFL is the present value of pension obligations in the defined benefit plan and is either based on the ABO (PFL1), or the PBO (PFL2). The NDBPA (NDBPL) is the market value of assets (liabilities) invested in non-defined plans, NDB plans. MVE is the market capitalization of the firm. BVE is the book value of equity of the firm, allowing for any company stock investment depending on how the pension plan liability is defined. NFL is the total (non-pension) financial liabilities of the firm. The value of the put option is the estimates of the corporate guarantee and the value of the call option is the estimates of the pension fund net worth.

The total pension plan liabilities and asset values are much higher than under the implicit approach (iii) due to the additional recognition of the net worth of unfunded post-retirement NDB plans, although the consolidation reduces this value through the equity elimination of investment in company sponsoring stock. The pension assets and liabilities also incorporate estimates of future cash flows, risk capital, and credit insurance margins which insurance firms would expect to incur. This in turn also increases the amount of equity in the ‘combined’ firm.¹⁴

The insurance hypothesis, advanced by Bodie (1990), assumes that shareholders of the sponsoring firm share the ownership of future pension deficit (surplus) with the employees in a form of a put (call) option.¹⁵ Shareholders, therefore, have the option to default on the portion of pension liabilities that are not covered by the pension fund’s collateral (i.e., plan assets) (Bodie 1990).¹⁶ A curtailment transaction can thus be viewed as the firm’s exercise of a ‘default’ option on this shared ownership. This ‘default’ option is exercisable when the action is optimal for the sponsoring firm. It is possible that pension curtailments will constitute part of a broader corporate restructuring program. Consequently, it is predicted

that pension curtailments with subsequent corporate restructuring are associated with the likelihood of default on pension obligations. Marcus (1985) applies option-pricing theory in estimating the value of firms' put option to default on their portion of pension liabilities. The put option values derived in Marcus (1985) allow for the calculation of fair value-based measures of pension obligations in which the sponsoring firm's termination decision is determined endogenously under various operating conditions. Following Marcus (1985), the estimate of the put option value is derived as a proxy measure for firms' propensity to exercise the default option (PUT). Marcus defines the rate of firm contributions into the pension fund net of payments to retirees; this is calculated as the difference between the periodic pension employer contributions less the periodic pension benefits divided by end of period ABO. Marcus also defines a 'net growth rate in accrued benefits attributable to demographic factors'. This is defined as the periodic difference between accrued pension cost and the pension benefits deflated by end of period ABO.

Table 3 reports relevant data on the composition of the pension plans sponsored by these companies. It shows the impact of pensions as a percentage of firm value. The amount of DB and, NDB plan net worth as a proportion of total corporate market capitalization is shown. The total percentage of DB and NDB plan investments in the corporate sponsor's own stock is also shown. It averages nearly 5% in 2006, but this reduces to 3% in 2008. The decrease is due to the declining economic significance of plans relative to stock options over this period. Relative to stockholders' equity, both DB and NDB plan pension funds are on average very significant. It should be noted that this descriptive statistical information is not available from JMB as neither the sample selection procedure nor the composition of the data sets is described. Consequently, it is not possible to establish whether the descriptive statistics are comparable to those of JMB.

Table 3. Pension asset categories as reported in Money Market Directory, 2006–2008.

Description	Average Asset Allocation DB (%)	Average Asset Allocation DC Plan (%)	Assumed Beta	Indicated in JMB
Bonds	18.2	4.1	0.175	0.175
Corporate bonds	1.8	0.3	0.230	0.175
Government bonds	2.1	0.5	0.179	0.175
Municipal bonds	0.1	0.2	0.205	0.175
Inflation-linked bond	2.3	0.6	0.102	0.175
International bonds	1.0	0.2	0.175	0.175
High-yield bonds	0.6	0.0	0.175	0.175
General insurance	0.6	13.4	0.205	0.175
Convertible bond	0.2	0.0	0.205	0.175
Small-cap value	1.0	0.5	2.012	1.0
Small-cap growth	1.1	0.5	1.372	1.0
Small cap	5.0	1.3	1	1.0
Large-cap value	2.5	1.3	1.359	1.0
Large-cap growth	2.0	1.2	0.717	1.0
Large cap	8.1	1.2	1	1.0
Growth equities	2.1	1.6	1.044	1.0
Value equities	2.6	1.1	1	1.0

Table 3. Cont.

Description	Average Asset Allocation DB (%)	Average Asset Allocation DC Plan (%)	Assumed Beta	Indicated in JMB
Indexed equities	8.5	8.2	1	1.0
International equity	12.0	2.1	1	1.0
Equities	16.9	8.6	1	1.0
Cash	2.04	2.5	0.06	0.06
Property	2.1	0.2	0.15	0.150
Company stock	1.9	35.2	Equity beta	Equity beta
Other investments	5.26	15.2	0.795	1.0

We use the CAPM to back out the systematic risk beta for various types of assets in pension funds. Relevant assumptions are consistent with Brealey et al. (2006) in capital market history in the 1926–2005 period. Specifically, we assumed the T-bill rate is 4.2%, the average market return is assumed to be 12%, and the average risk premium is assumed to be 7.8%. The average annual return rate for large-firm stocks is 12.3%, and 17.4% for small firms, the yield for long-term corporate bonds is 6.2%, yield for long-term government bonds is 5.8%, intermediate-term government bond yield is 5.5%, and the yield for US Treasury bills is 3.8%. The high-yield bond is assumed to be 8%, which is between the large-stock and corporate bond. Municipal yields are assumed to the same as long-term government bonds. Inflation-linked bonds earn 5% ‘real’ return. Both capital guaranteed insurance and convertibles are assumed to yield 5.8% as long-term government bonds. The returns on small-cap value stock and large-cap stocks are assumed to be $17.4\% \pm 2.5\%$; The returns on large-cap value and growth stocks are assumed to be $12.3\% \pm 2.5\%$. This is consistent with the average annual difference between the returns on value stock and growth stock which have been about 5% since 1926. Betas of other equity classes, including index and international equities, are assumed to be 1.

Table 3 also shows the assumed beta of each asset category identified by the Money Market Directory (MMD). The MMD lists at a detailed level, the asset composition of pension schemes on a ‘functional’ basis. For example, MMD decomposes investments across various debt instruments, from government bonds, corporate bonds, high-yield bonds, convertible bonds, indexed linked bonds, and international bonds. Similarly pension equities are decomposed into various risk classes, including small, medium, or large stock, and/or growth versus value stocks, as well as international, indexed, and emerging market equities.

The asset allocation for the relevant DB plan and NDB plan is shown separately in the table. Note that NDB plans, on average, have invested 35% of a sponsoring company’s stocks relative to 2% invested by DB plans. This has important implications for risk transformation and changes in capital structure for sponsoring companies.

JMB suggests that the cost of capital should be ‘corrected’ to allow for both the value and risk of pension plans. However, they do not consider NDB plans, which have a significant investment in the sponsoring company’s own stock. Since NDB plans own a significant proportion of company own stock, they can be ‘eliminated upon consolidation’ in recognizing the equity or ‘book value’ of the sponsoring company, i.e., by eliminating these common investments made by ‘undiversified’ investors. Because of the materiality and increasing economic significance of such investments by NDBs, they also complicate the relationship of pension risk to firm risk as if it were just a form of systematic risk, as represented by JMB.

4. Empirical Results

This section re-examines the empirical results previously reported in JMB concerning the formal relationship between firm risk and pension risk, using Fama McBeth regressions. The results are confined to non-distressed firms since firms in financial distress are likely to behave differently from non-distressed firms due to PBGC.

Following the procedure used in JMB, three measures are used to identify financially distressed firms: book to market, return on investment, and leverage. These capture measures of overall risk, operating risk and financial risk. Then, in each year of the sample,

all firms are ranked by each measure of financial distress, and the deciles of firms with the most severe measure as distressed and the rest are treated as non-distressed. Regressions are run on firms that are not in distress in the previous year. The following panel data regression is fitted, where Equation (11) is the adjusted specification for case (iv), i.e., where the SOE plan is merged with the firm, but as a separate financial services entity.

$$\beta_{E+NFL} = a + b\beta_{pension1} + controlvariable + \varepsilon \quad (11)$$

In terms of the PEEM, where the presently off-balance sheet SOE plans and the DB plans are ‘fully consolidated’; i.e., either merged with the firm as an additional or consolidated as an equity investment, the JMB model is adjusted as follows:

$$NOA + PA_{DB} + PA_{SOE} - (PL_{DB} + PL_{SOE}) + OPT = NFL + E,$$

or

$$NOA + PA_{DB} + (PA_{SOE} - E_{EE}) - (PL_{DB} + PL_{SOE}) + OPT = NFL + E_{CE},$$

and both DB and SOE net pension plan risks are separately ‘consolidated’ into the firms’ accounts consistent with case (iv). Note that

$$\begin{aligned} \beta_{E+NFL} &= \frac{E}{E+NFL} \beta_E + \frac{NFL}{E+NFL} \beta_{NFL} \\ \beta_{ECE+NFL} &= \frac{E_{CE}}{E_{CE}+NFL} \beta_E + \frac{NFL}{E_{CE}+NFL} \beta_{NFL} \end{aligned}$$

Therefore, β_{E+NFL} can be rewritten as

$$\beta_{E+NFL} = \beta_{DB1} + \beta_{SOE} + \frac{NOA}{E+NFL} \beta_{NOA} + \frac{OPT}{E+NFL} \beta_{OPT} \quad (12)$$

where

$$\begin{aligned} \beta_{DB} &= \left(\frac{PA_{DB}}{E+NFL} \beta_{PA_{DB}} - \frac{PL_{DB}}{E+NFL} \beta_{PL_{DB}} \right) \\ \beta_{SOE} &= \left(\frac{PA_{SOE}}{E+NFL} \beta_{PA_{SOE}} - \frac{PL_{SOE}}{E+NFL} \beta_{PL_{SOE}} \right). \end{aligned}$$

Similarly, $\beta_{ECE+NFL}$ can be rewritten as

$$\beta_{ECE+NFL} = \beta_{DB2} + \beta_{DCE} + \frac{NOA}{E_{CE}+NFL} \beta_{NOA} + \frac{OPT}{E_{CE}+NFL} \beta_{OPT} \quad (13)$$

where

$$\begin{aligned} \beta_{DB2} &= \left(\frac{PA_{DB}}{E_{CE}+NFL} \beta_{PA_{DB}} - \frac{PL_{DB}}{E_{CE}+NFL} \beta_{PL_{DB}} \right) \\ \beta_{DCE} &= \left(\frac{PA_{SOE}}{E_{CE}+NFL} \beta_{PA_{DCE}} - \frac{PL_{SOE}}{E_{CE}+NFL} \beta_{SOE} \right) \end{aligned}$$

$PA_{SOEE} = PA_{SOE} - E_{EE}$, and PA_{DCE} is the systematic risk of PA_{SOEE} .

We can use the relationships in Equations (12) and (13) to test whether the beta risk of pension is incorporated in the risk of the firm’s capital structure as below:

$$\beta_{E+NFL} = a + b\beta_{pension1} + \varepsilon \quad (14)$$

$$\beta_{ECE+NFL} = a + b\beta_{pension2} + \varepsilon \quad (15)$$

where $\beta_{pension1} = \beta_{DB1} + \beta_{SOE}$, and $\beta_{pension2} = \beta_{DB2} + \beta_{DCE}$

In these regressions, b and c represent the sensitivity of firm risk to firm pension risks, and intercept a represents the part of the expected firm risk that cannot be captured by the

pension risks. A number of instrumental variables are to pick up the effect of the intercept and expect b and c to be positive.

4.1. Pension Risk and Cost of Capital

Table 4 shows the beta estimates, relating to each of the three alternative treatments of measuring DB pension liability contracts outlined above.¹⁷: (i) where the reported defined benefit pension obligation is measured as the accrued benefit obligation (ABO), based on the AEM of the reporting entity; (ii) where the reported defined benefit pension obligation is measured as the projected benefit obligation (PBO) based on the PEEM of the reporting entity, and additionally includes other elements of the deferred compensation package, e.g., unfunded health care obligations, defined contribution plans, 401K plans, as well as implicit calls and puts on the PBGC.¹⁸

Table 4. Estimates of pension asset and operating betas. (Averages with standard deviation in brackets).

Case	Operating Asset Beta Correct	Operating Asset Beta Error 1	% Overestimate for Error 1	Operating Asset Beta Error 2	% Overestimate for Error 2
Panel A: based on this study's assumptions					
(i): ABO	0.560 (1.432)	0.775 (1.403)	38.3	1.186 (7.331)	111.7
(ii): PBO	0.561 (1.432)	0.770 (1.394)	37.2	1.117 (6.221)	99.1
Panel B: based on JMB assumptions					
(i): ABO	0.297 (0.287)	0.543 (0.537)	82.8	0.574 (0.599)	93.3
(ii): PBO	0.297 (0.287)	0.509 (0.334)	71.3	0.565 (0.551)	90.2
Panel C: t-statistics difference A-B					
(i): ABO	4.005	3.477		1.775	
(ii): PBO	4.005	4.142		1.909	
(iii): ABO vs. PBO	−1.501	0.716		0.969	

This table reports the average pension risk and overestimation of cost of operating assets for cases (i) (PBO), (ii) (ABO), and (iii) PBO. Beta of equity is estimated using capital asset pricing model, using data on three-year monthly stock return, obtained from the Center for Research in Security Prices, and the value-weighted return on all stocks on NYSE, AMEX, and Nasdaq as the proxy for market. Operating asset beta correct is the operation asset beta when correctly accounting for pension value and risk, operating asset beta error 1 is the operating asset beta ignoring pension plan altogether, and operating asset beta error 2 is the operating asset beta counting pension value but misrepresenting pension risk.

Table 4 shows that the beta estimates for firm operating asset beta slightly increase from cases (i) to (iii) as more risk is taken on by the pension liability risk measure. The operating asset beta errors related to risk (error 2) are significantly higher than when value and risk (error 1).

Table 5 reports the cost of capital estimates based on the betas reported in Table 4 and the CAPM. The cost of capital is increasing as the definition of pension liability is broadened from ABO to PBO. In this case, the overestimates related to risk (error 2) are again significantly greater than the errors related to valuation overestimates (error 1). The results also show significant variation across the cases.¹⁹ Panel B shows the corresponding cost of capital estimates based on assumptions consistent with those used by JMB. These estimates are also significantly higher than the cost of capital estimates estimated using JMB's assumptions (panel C), and moreover, increase as the level of pension obligation increases from ABO to PBO.

Table 5. Cost of capital estimates. (Averages with standard deviation in brackets.).

Case	Correct Cost of Capital Estimate (%)	Cost of Capital Estimate Error 1 (%)	% Overestimate for Error 1	Cost of Capital Estimate Error 2 (%)	% Overestimate for Error 2
Panel A: based on our assumptions					
(i): ABO	7.448 (10.734)	9.341 (10.192)	25.5	12.218 (51.231)	63.8
(ii): PBO	7.842 (10.411)	9.317 (10.274)	18.7	11.730 (44.485)	49.2
Panel B: based on JMB assumptions					
(i): ABO	7.088 (3.718)	7.712 (4.423)	8.9	7.929 (4.737)	11.8
(ii): PBO	5.993 (2.822)	7.479 (3.508)	24.8	7.822 (4.220)	30.5
Panel C: <i>t</i> -statistics difference A-B					
(i): ABO	0.742	3.477		1.776	
(ii): PBO	4.005	4.104		1.909	
(iii): ABO vs. PBO	−1.501	0.662		0.969	

This table reports the average systematic risk and overestimation of cost of operating assets for cases (i)–(iii). Beta of equity is estimated using capital asset pricing model, using data on three-year monthly stock return, obtained from the Center for Research in Security Prices, and the value-weighted return on all stocks on NYSE, AMEX, and Nasdaq as the proxy for market. Operating asset beta correct is the operation asset beta when correctly accounting for pension value and risk, operating asset beta error 1 is the operating asset beta ignoring pension plan altogether, and operating asset beta error 2 is the operating asset beta counting pension value but misrepresenting pension risk.

Following the procedure outlined in JMB, we run Fama and MacBeth (1973) methodology OLS time series tests to compute robust standard errors for the coefficient estimates, by first running cross-sectional regressions for each year separately, while controlling for fixed effects at the industry levels using the two-digit Standard Industrial Classification (SIC) code, and report the time-series averages of the coefficient estimates and use the time series standard errors of the average slopes to draw inferences. The regression coefficients for each of the three measures of risk and their *t*-statistics are initially reported for the ‘simplistic’ cases (i) and (ii) in Table 6.

Table 6. Relation between pension risk and firm risk: simple regression: non-distressed firms (existing and new GAAP, standard deviation in brackets).

Panel A: Case i—ABO						
	Asset Allocation/Financial Distress Assumption					
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.037 (0.097)	1.049 (0.091)	1.028 (0.109)	1.042 (0.093)	1.029 (0.096)	1.042 (0.087)
Pension risk	0.103 (0.097)	0.144 (0.206)	0.097 (0.146)	0.108 (0.229)	0.080 (0.116)	0.105 (0.213)
No. of observations	672	672	672	672	672	672
R-Squared	0.015	0.010	0.017	0.010	0.015	0.010

Table 6. Cont.

Panel B: Case ii—PBO						
	Asset Allocation/Financial Distress Assumption					
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.035 (0.101)	1.045 (0.095)	1.024 (0.112)	1.032 (0.098)	1.030 (0.096)	1.039 (0.089)
Pension risk	0.119 (0.134)	0.262 (0.350)	0.154 (0.190)	0.249 (0.331)	0.078 (0.109)	0.191 (0.347)
No. of observations	672	672	672	672	672	672
R-Squared	0.030	0.025	0.037	0.027	0.018	0.017

This table reports regression results for the sample from 2004 to 2008 using the procedure described in Jin et al. (2006, p. 14). The regression being run for cases (i) and (ii) is Equation (9) with $\beta_{SOE} = 0$: $\beta_{E+NFL} = a + b\beta_{pension1} + \varepsilon$. All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. The regression is run for each year, controlling for fixed effect at the industry level, and then the time series mean, and standard deviation of the regression coefficients are used to make inferences. The standard deviation, reported under each coefficient and in parenthesis, is further adjusted for potential time series correlation.

Contrary to the results reported in JMB, this study finds large variation in the pension asset betas. The standard deviations increase as we move from the ABO towards the PBO. Furthermore, in none of the cases, this study finds a significant association between firm risk and pension risk, contrary to the results obtained by JMB. This is due to an error in variables problem, different specifications of data, or to a different time period.

4.2. Tests by Incorporating Various Control Variables for Operating Asset Risk

This paper follows JMB by running multiple regressions which incorporate various control variables as proxies for differences in the no-pension operating asset risks across the firms.

The list of control variables and the procedures used to describe them are also initially based on those described in Jin et al. (2006, p. 15) and are reproduced again in Table 7.

Table 7. List of control variables (following Jin et al. 2006, p. 15).

Variable	Calculation	Compustat Item No.
Market share by value	Calculated using market value and the industry classification codes	DATA24/DATA25
Market share by sales	Calculated using total sales and the industry classification codes	DATA12
Capital intensiveness	Current assets/total assets	DATA4/DATA6
Cash position	Cash and short-term investments/total assets	DATA1/DATA6
Financial leverage	Debt/total assets/	(Data9 + Data34)/DATA6
Growth rate	Log (total assets/lagged total assets)	Log (DATA6)/DATA6_lag)
Liquidity	Current assets/current liabilities	DATA4/DATA5
Return on investment	Net income/total assets	DATA172/DATA6
Firm size	Log (total assets)	Log (DATA6)
Research and development	Research and development expense/total assets	DATA46/DATA6
Advertisement	Advertising expense/total assets	DATA45/DATA6

The results of the Fama and MacBeth (1973) multiple regressions with control variables are listed in Table 8.

Table 8, Panel A shows that neither old US GAAP (ABO) or new US GAAP (PBO) (i.e., cases (i) and (ii), respectively) demonstrate any relationship between firm risk and pension risk. However, there are limitations associated with estimating standard pension risk to firm risk comparisons in the latter cases, since the consolidation or merger of the pension plans with the sponsoring firm also change the nature of overall firm risk. This issue is examined further in Section 5 below.

Table 8. Relation between pension risk and firm risk: regression: non-distressed firms.

Panel A: Case i—ABO						
	Asset Allocation/Assumption					
	Book-Market Ratio		Return on Investments		Financial Leverage	
	B_{PL} = 0.18	B_{PL} = 0.46	B_{PL} = 0.18	B_{PL} = 0.46	B_{PL} = 0.18	B_{PL} = 0.46
Intercept	1.895 (0.392)	1.875 (0.385)	2.004 (0.384)	1.976 (0.382)	2.147 (0.570)	2.125 (0.566)
Pension risk	0.113 (0.100)	0.158 (0.162)	0.190 (0.188)	0.142 (0.213)	0.081 (0.092)	0.114 (0.161)
Market share by value	−0.246 (0.125)	−0.247 (0.124)	−0.211 (0.222)	−0.206 (0.216)	−0.151 (0.232)	−0.144 (0.224)
Market share by sales	0.130 (0.204)	0.148 (0.196)	0.152 (0.173)	0.154 (0.160)	0.143 (0.168)	0.147 (0.160)
Capital intensiveness	0.239 (0.240)	0.257 (0.251)	0.185 (0.218)	0.219 (0.249)	0.152 (0.204)	0.176 (0.236)
Cash position	0.407 (0.779)	0.402 (0.770)	0.556 (0.726)	0.554 (0.721)	0.586 (0.754)	0.584 (0.738)
Financial leverage	−0.277 (0.171)	−0.296 (0.131)	−0.401 (0.187)	−0.422 (0.172)	−0.643 (0.324)	−0.660 (0.292)
Growth rate	0.414 (0.514)	0.395 (0.515)	0.571 (0.561)	0.564 (0.573)	0.506 (0.564)	0.493 (0.570)
Liquidity	0.001 (0.003)	0.001 (0.003)	0.001 (0.002)	0.001 (0.002)	0.000 (0.004)	0.000 (0.004)
Return on investment	−0.015 (2.188)	−0.054 (2.285)	0.191 (2.224)	0.067 (2.358)	−0.299 (2.012)	−0.362 (2.101)
Firm size	−0.090 (0.049)	−0.087 (0.049)	−0.102 (0.052)	−0.097 (0.052)	−0.103 (0.060)	−0.098 (0.062)
Advertisement	−2.825 (2.135)	−2.787 (2.140)	−1.870 (1.756)	−1.838 (1.750)	−1.887 (1.078)	−1.851 (1.081)
Research and development	1.170 (2.207)	1.154 (2.097)	1.094 (1.765)	0.812 (2.061)	0.463 (2.070)	0.417 (2.037)
No. of observations	684	684	684	684	684	684
R-Squared	0.278	0.275	0.282	0.277	0.277	0.275

Table 8. Cont.

Panel B: Case ii—PBO						
Asset Allocation/Financial Distress Assumption						
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.887 (0.396)	1.864 (0.393)	2.000 (0.387)	1.965 (0.385)	2.152 (0.576)	2.128 (0.575)
Pension risk	0.116 (0.131)	0.264 (0.255)	0.111 (0.176)	0.326 (0.254)	0.101 (0.132)	0.195 (0.290)
Market share by value	−0.199 (0.152)	−0.207 (0.130)	−0.174 (0.240)	−0.169 (0.220)	−0.140 (0.227)	−0.105 (0.255)
Market share by sales	0.076 (0.234)	0.104 (0.207)	0.112 (0.217)	0.118 (0.182)	0.182 (0.178)	0.102 (0.208)
Capital intensiveness	0.216 (0.228)	0.250 (0.216)	0.147 (0.193)	0.192 (0.220)	0.100 (0.240)	0.165 (0.235)
Cash position	0.455 (0.838)	0.456 (0.835)	0.587 (0.793)	0.581 (0.798)	0.447 (0.783)	0.560 (0.724)
Financial leverage	−0.226 (0.242)	−0.247 (0.203)	−0.352 (0.242)	−0.384 (0.204)	−0.622 (0.300)	−0.648 (0.270)
Growth rate	0.404 (0.500)	0.385 (0.504)	0.577 (0.550)	0.571 (0.572)	0.509 (0.561)	0.505 (0.573)
Liquidity	0.001 (0.003)	0.001 (0.003)	0.001 (0.002)	0.001 (0.002)	0.000 (0.004)	0.000 (0.004)
Return on investment	0.096 (2.082)	0.062 (2.153)	0.306 (2.029)	0.176 (2.135)	−0.276 (2.007)	−0.342 (2.108)
Firm size	−0.092 (0.052)	−0.089 (0.051)	−0.104 (0.053)	−0.099 (0.053)	−0.104 (0.063)	−0.101 (0.063)
Advertisement	−2.916 (2.147)	−2.883 (2.071)	−1.904 (1.703)	−1.884 (1.601)	−1.832 (1.065)	−1.762 (1.070)
Research and development	2.312 (1.618)	2.516 (2.066)	2.011 (1.843)	1.847 (1.643)	0.449 (1.927)	0.384 (1.783)
No. of observations	684	684	684	684	684	684
R-Squared	0.284	0.281	0.291	0.286	0.276	0.278

Panel A: This table reports regression results for the sample from 2004 to 2008 using the procedure described in Jin et al. (2006, 14) and based on US GAAP. The regression being run is $\beta_{E+NFL} = a + b\beta_{pension1} + controlvariable + \varepsilon$. All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. The regression is run for each year, controlling for fixed effect at the industry level, and then the time series mean, and standard deviation of the regression coefficients are used to make inferences. The standard deviation, reported under each coefficient and in parenthesis, is further adjusted for potential time series correlation. Panel B: This table reports regression results for the sample from 2004 to 2008 using the procedure described in Jin et al. (2006, p. 14) in cases where the pension plan is subject to new GAAP (i.e., discount only accrued pension liabilities using risk-free rate). The regression being run is $\beta_{ECE+NFL} = a + b\beta_{pension2} + controlvariable + \varepsilon$. All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. The regression is run for each year, controlling for fixed effect at the industry level, and then the time series mean, and standard deviation of the regression coefficients are used to make inferences. The standard deviation, reported under each coefficient and in parenthesis, is further adjusted for potential time series correlation.

5. Robustness Checks and Filtered Tests

This section reports various robustness checks on the regression results that were reported in Section 4, following the procedures described in JMB for financial distressed firms and filtered tests, and then delineates sub-samples of DB pension terminating from non-terminating firms.

5.1. Financially Distressed Firms

Following Jin et al. (2006, p. 17), this study first re-runs the regression analysis specified in Table 8. JMB posit that distressed firms are likely to have a distinctly different pattern than non-distressed firms. Table 9 reports the results.

Table 9. Relation between pension risk and firm risk: simple regression: distressed firms (existing and new GAAP, standard deviation in brackets).

Panel A: Case i ABO						
	Asset Allocation/Financial Distress Assumption					
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.001 (0.287)	0.932 (0.206)	1.047 (0.145)	1.058 (0.126)	0.843 (0.167)	0.892 (0.162)
Pension risk	−0.386 (1.310)	0.603 (0.789)	0.098 (0.160)	0.130 (0.230)	0.676 (0.757)	1.066 (1.088)
No. of observations	75	75	75	75	75	75
R-Squared	0.055	0.037	0.075	0.069	0.229	0.260
Panel B: Case ii PBO						
	Asset Allocation/Financial Distress Assumption					
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.018 (0.261)	0.968 (0.192)	0.989 (0.160)	1.050 (0.133)	0.841 (0.156)	0.904 (0.144)
Pension risk	−0.420 (0.969)	0.016 (0.971)	0.195 (0.254)	0.355 (0.353)	0.687 (0.754)	1.145 (1.028)
No. of observations	75	75	75	75	75	75
R-Squared	0.071	0.030	0.084	0.077	0.207	0.222

This table reports regression results for the sample from 2004 to 2008 using the procedure described in Jin et al. (2006, p. 14). The regression being run for cases (i) and (ii) is Equation (9) with $\beta_{SOE} = 0$. $\beta_{E+NFL} = a + b\beta_{pension1} + controlvariable + \varepsilon$. All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. The regression is run for each year, controlling for fixed effect at the industry level, and then the time series mean, and standard deviation of the regression coefficients are used to make inferences. The standard deviation, reported under each coefficient and in parenthesis, is further adjusted for potential time series correlation.

The overall results for financially distressed firms are not consistent with those reported by JMB and show that the relation between pension risk and firm risk are even more significant for those firms relative to the simple regression results reported in Table 6 for non-distressed firms. These results may be attributed to differences associated with the more restricted sample selection procedures used in this study, since up to two-thirds of the JMB sample did not include firms with significant pension exposure, whereas over 90% of the sample of firms in this study did so.²⁰

5.2. Exclude Firms with Significant Company Stock in the Pension Plan

Following the procedure suggested by JMB (Table 10), the baseline regressions are also rerun by excluding pension investment in company own stock. However, the outcome of this procedure is more significant since we also include company stock owned by SOE plans, which is both material and has a bearing on overall equity ownership between outside equity holders and non-diversified employee holders.

The results reported in Table 10 are nevertheless largely consistent with those reported in our Table 8 but with a slight but significant increase in explanatory power of the overall regressions. Thus, eliminating the company stock ownership significantly enhances the relation of firm risk to pension risk, but only at the conditioning of the external stockholders from the inside employee stockholders.

5.3. Filter Tests

Following JMB, filter tests are conducted to examine whether our results are robust to restricting the sample to only those firms with at a minimum threshold of pension exposure. These tests (not reported) replicated the analysis in JMB by restricting the threshold to the proportion of DB pension assets relative to firm debt and equity. Those results further corroborate earlier findings reported in Table 8 that, contrary to those obtained by JMB, there is no significant relation between pension risk and firm risk.

Table 10. Robustness check with impact of employer security removed from security risk.

Panel A: Case i—ABO						
	Financial Distress Assumption					
	Book-Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.895 (0.391)	1.865 (0.379)	1.913 (0.466)	1.877 (0.462)	2.147 (0.570)	2.126 (0.566)
Pension risk	0.113 (0.100)	0.053 (0.193)	0.108 (0.138)	0.157 (0.199)	0.081 (0.092)	0.114 (0.161)
Market share by value	−0.246 (0.125)	−0.167 (0.237)	−0.246 (0.159)	−0.255 (0.148)	−0.151 (0.232)	−0.144 (0.223)
Market share by sales	−0.246 (0.125)	−0.167 (0.237)	−0.246 (0.159)	−0.255 (0.148)	−0.151 (0.232)	−0.144 (0.223)
Capital intensiveness	0.239 (0.240)	0.287 (0.270)	0.235 (0.238)	0.273 (0.262)	0.152 (0.204)	0.176 (0.236)
Cash position	0.407 (0.779)	0.211 (0.864)	0.589 (0.696)	0.493 (0.841)	0.586 (0.754)	0.584 (0.738)
Financial leverage	−0.277 (0.171)	0.053 (0.675)	−0.300 (0.140)	−0.322 (0.136)	−0.643 (0.324)	−0.660 (0.292)
Growth rate	0.412 (0.514)	0.255 (0.250)	0.577 (0.562)	0.568 (0.575)	0.506 (0.564)	0.493 (0.570)
Liquidity	0.001 (0.003)	0.558 (1.246)	0.001 (0.002)	0.001 (0.002)	0.000 (0.004)	0.000 (0.004)
Return on investment	−0.015 (2.188)	−0.644 (1.665)	0.418 (2.239)	0.322 (2.380)	−0.299 (2.012)	−0.362 (2.101)
Firm size	−0.090 (0.049)	−1.335 (2.836)	−0.098 (0.057)	−0.093 (0.056)	−0.103 (0.060)	−0.100 (0.060)
Advertisement	−2.825 (2.135)	−1.199 (1.678)	−2.078 (1.951)	−2.048 (1.953)	−1.887 (1.078)	−1.851 (1.081)
Research and development	1.170 (2.207)	0.912 (2.112)	1.633 (2.025)	1.394 (2.438)	0.463 (2.070)	0.417 (2.037)
No. of observations	684	684	684	684	684	684
R-Squared	0.2788	0.275	0.254	0.287	0.277	0.275

Table 10. Cont.

Panel B: Case ii PBO						
	Financial Distress Assumption					
	Book—Market Ratio		Return on Investments		Financial Leverage	
	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46	B _{PL} = 0.18	B _{PL} = 0.46
Intercept	1.887 (0.396)	1.864 (0.393)	1.894 (0.482)	1.857 (0.473)	2.152 (0.576)	2.128 (0.575)
Pension risk	0.116 (0.131)	0.051 (0.282)	0.106 (0.177)	0.285 (0.312)	0.074 (0.098)	0.195 (0.290)
Market share by value	−0.212 (0.141)	−0.038 (0.272)	−0.225 (0.204)	−0.202 (0.198)	−0.113 (0.272)	−0.105 (0.255)
Market share by sales	0.088 (0.222)	−0.019 (0.132)	0.085 (0.233)	0.188 (0.217)	0.095 (0.227)	0.102 (0.208)
Capital intensiveness	0.216 (0.228)	0.394 (0.143)	0.210 (0.224)	0.074 (0.389)	0.146 (0.192)	0.165 (0.235)
Cash position	0.455 (0.838)	0.291 (0.878)	0.525 (0.860)	0.572 (0.816)	0.574 (0.754)	0.560 (0.724)
Financial leverage	−0.225 (0.242)	−0.135 (0.335)	−0.242 (0.168)	−0.139 (0.345)	−0.622 (0.300)	−0.648 (0.270)
Growth rate	0.404 (0.500)	0.317 (0.534)	0.584 (0.552)	0.493 (0.631)	0.509 (0.561)	0.505 (0.573)
Liquidity	0.001 (0.003)	−0.079 (0.180)	0.001 (0.002)	0.131 (0.290)	0.000 (0.004)	0.000 (0.004)
Return on investment	0.096 (2.082)	0.122 (2.141)	0.583 (2.055)	0.328 (2.184)	−0.276 (2.007)	−0.342 (2.108)
Firm size	−0.092 (0.052)	−0.409 (0.725)	−0.099 (0.059)	−0.376 (0.605)	−0.104 (0.063)	−0.101 (0.063)
Advertisement	−2.916 (2.146)	−2.540 (2.426)	−2.137 (1.775)	−1.338 (2.684)	−1.832 (1.065)	−1.772 (1.072)
Research and development	2.312 (1.618)	2.649 (1.877)	2.508 (1.730)	1.891 (1.921)	0.382 (1.945)	0.384 (1.783)
No. of observations	684	684	684	684	684	684
R-Squared	0.284	0.281	0.301	0.293	0.280	0.276

This table reports regression results for the sample from 2004 to 2008 using the procedure described in Jin et al. (2006, p. 14). This regression being run is $\beta_{E_{CE}+NFL} = a + b\beta_{pension2} + control\ variables + \epsilon$. For case (iv), it is the extended model applicable to the combined entity of the firm and the sponsored SOE/SOE plan; i.e., $\beta_{E_{CE}+NFL} = a + b\beta_{DB2} + c\beta_{DCE} + controlvariable + \epsilon$. All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. The regression is run for each year, controlling for fixed effect at the industry level, and then the time series mean, and standard deviation of the regression coefficients are used to make inferences. The standard deviation, reported under each coefficient and in parenthesis, is further adjusted for potential time series correlation.

5.4. DB Pension Plan Termination Decisions

One of the more intriguing aspects of the baseline results reported in Table 4 is the equivocal nature of the relation of firm overall risk, pension risk, and their components to pension plan termination decisions. This section examines this issue by decomposing the sample between continuing (i.e., surviving DB plan sponsors) and terminating DB pension plan sponsors.²¹

Approximately one-third of the sample firms terminated their DB pension plans during the three-year period of 2006–2008, when the schemes were subject to significant changes in both regulation and GAAP-based reporting and funding requirement. The remaining

two-thirds of the sample firms (283 pooled firm observations) continued to operate the schemes over the three fiscal reporting years subsequent to that ending 2008. To address this issue, baseline results reported in Tables 6 and 7 delineate between DB-continuing and DB-terminating pension plan sponsors.

Table 11 reports the results of a regression of firm systematic risk and pension risk, again separately for continuing (Panel A) and terminating (Panel B) firms.²² Moreover, these results hold after controlling for significant relationships between firm systematic risk and other factors posited by JMB, including cash position, financial leverage, and research and development.

Table 11. Relation between pension beta and firm systematic risk: OLS regression (DB plan-surviving firms vs. DB plan-terminating firms).

Panel A: Surviving Firms (n = 283 Firm Observations)				
	Pension Asset Allocation/Pension Liability Assumption			
	Beta = ABO		Beta = PBO	
	Equation (9)	Equation (10)	Equation (9)	Equation (10)
Intercept	0.133 (0.765)	0.087 (0.760)	2.047 (1.388) *	1.962 (1.381)
Pension risk	−0.122 (0.173)	−0.399 (0.204)	−0.251 (0.315)	−0.627 (0.552)
Market share by value	−0.003 (0.001)	−0.003 (0.001)	−0.003 (0.001)	−0.004 (0.001)
Capital intensiveness	−0.237 (0.434)	−0.232 (0.429)	−0.795 (0.788)	−0.811 (0.779)
Cash position	2.107 (0.949)	2.115 (0.942)	4.717 (1.722) ***	4.758 (1.711) ***
Financial leverage	−1.048 (0.345) **	−1.122 (0.349) ***	−1.011 (0.626) *	−1.114 (0.634) ***
Growth rate	−0.143 (0.297)	−0.176 (0.296)	0.195 (0.539)	0.146 (0.539)
Liquidity	−0.002 (0.002)	−0.002 (0.002)	−0.000 (0.004)	−0.001 (0.004)
Return on investment	−0.516 (0.907)	−0.386 (0.900)	0.140 (1.645)	1.710 (3.239)
Firm size	0.095 (0.077)	0.099 (0.077)	−0.063 (0.140)	0.144 (0.277)
Advertisement	0.574 (1.502)	0.389 (1.503)	−1.445 (2.725)	−1.334 (5.408)
Research and development	0.172 (0.719)	0.204 (0.715)	0.115 (1.304)	0.053 (2.573)
Idiosyncratic risk	−0.018 (0.036)	−0.015 (0.035)	−0.078 (0.065)	−0.153 (0.128)
No. of observations	450	450	450	450
R-Squared	0.065	0.069	0.076	0.068

Table 11. Cont.

Panel B: Terminating Firms (n = 167 Firm Observations)				
	Pension Asset Allocation/Pension Liability Assumption			
	Beta = ABO		Beta = PBO	
	Equation (9)	Equation (10)	Equation (9)	Equation (10)
Intercept	4.008 (2.628) *	3.542 (2.603)	2.278 (1.674)	2.208 (1.650)
Pension risk	−0.660 (0.537)	0.269 (0.432)	0.155 (0.342)	0.136 (0.274)
Market share by value	−0.004 (0.001)	−0.002 (0.001)	−0.004 (0.001)	−0.005 (0.001)
Capital intensiveness	−1.576 (1.321)	−1.337 (1.312)	1.462 (0.842) *	1.611 (0.832) **
Cash position	14.650 (1.882) ***	14.938 (1.814) ***	−2.423 (1.199) *	−2.546 (1.150) **
Financial leverage	−0.793 (1.337)	−0.191 (1.243)	−3.103 (0.852) ***	−3.157 (0.788) ***
Growth rate	0.270 (1.350)	0.251 (1.339)	−0.235 (0.860)	−0.163 (0.849)
Liquidity	−0.002 (0.027)	−0.006 (0.027)	−0.009 (0.017)	−0.009 (0.017)
Return on investment	−2.484 (2.313)	−2.469 (2.298)	0.932 (1.473)	0.873 (1.456)
Firm size	−0.294 (0.268)	−0.315 (0.264)	−0.063 (0.171)	−0.047 (0.167)
Advertisement	−1.492 (5.105)	−2.672 (4.990)	4.634 (3.252)	4.644 (3.163)
Research and development	−9.246 (9.558)	−10.360 (9.587) ***	−6.736 (6.090)	−7.320 (6.077)
Idiosyncratic risk	−0.164 (0.113) *	0.269 (0.432)	−0.110 (0.072) *	−0.113 (0.071) *
No. of observations	450	450	450	450
R-Squared	0.446	0.430	0.227	0.229

Note: *** 1% significance level, ** 5% significance level; * 10% significance level. Panel A: This table reports regression results of the relation between pension beta risk and firm beta risk for the sample from 2006 to 2008 separately for those firms which continued to operate DB pension plans (283 firm observations) and those which terminated DB plans during the previous five years (167 firm observations). This table reports regression results for the sample from 2006 to 2008. The regression being run is either $\beta_{E+NFL} = a + b\beta_{pension1} + control\ variables + \varepsilon$ or $\beta_{E+NFL} = a + b\beta_{pension2} + control\ variables + \varepsilon$. Results are reported separately for pension risk defined in accordance with Equation (14) (all equity) and Equation (15) (after controlling for employees' equity). All results are estimated with company betas estimated using the market model and one lagged term and with the end-of-year pension data. Standard deviations are shown in brackets. Panel B: This table reports regression results of the relation between pension beta risk and firm systematic risk for the sample from 2006 to 2008 separately for those firms which continued to operate DB pension plans (283 firm observations) and those which terminated DB plans during the previous five years (167 firm observations).

5.5. Analysis of Surviving Firms

This study was conducted during the period of 2006–2008, when both US GAAPs had clarified the previously confusing treatment of pension assets and liabilities that had partially motivated the JMB study, and when there was a sharp decline in DB pensions and a corresponding rise in DC plans in the United States (Wolff 2015). To investigate the impact of subsequent regulatory developments, further analysis of the surviving firms was conducted in the latest 2024 fiscal year reporting period. The analysis suggests that

two-thirds (105) of the original 150 sample firms survived and whose shares are actively traded listed in either the NYSE or Nasdaq stock exchanges. Moreover, while both the market value of equity and total financial debt of these firms has increased by 150%, their DB-sponsored pension plan assets and liabilities have only increased by 15% and 17%, respectively. In most cases, DB plans are also now financially immaterial in comparison to their entire business operations, in contrast to the situation formerly applicable to the JMB study in 1993–1998. Moreover, a third (36) of these firms have subsequently terminated or frozen their DB plans. Consequently, it is concluded that the proposal of this paper to apply the PEEM model of the MRE and incorporating NDB plans into the cost of capital estimates is both a valid and material issue and more likely reflects current market conditions.

6. Conclusions

Although the importance of human capital to corporations has been recognized by public policy makers and regulators as important elements of their long-term sustainable value, the cost of capital implications of employee commitments has received scant attention. This study contributes to this issue by examining how alternative treatments of equity-based employee compensation and models of the reporting entity can impact the sensitivity of cost of capital, that is premised on prior research (Forker 2000) which questions the standard entity perspective of the MRE that does not recognize the potentially material impact of employee investments in company own stock and other sources of corporate exposure to defined benefit pensions and unfunded health care benefits which are incorporated into the PEEM.

This study re-examines the cost of capital implications of prior research conducted by JMB in examining the relation between firm risk and pension risk, by considering the impact of applying alternative EM and PEEM reporting entity perspective that incorporates both explicit and implicit long-term contracts between a firm and its employees by quantifying and then analyzing the impact of stock divestitures and investments in company own stock by employee pension, post-retirement, and equity stock investments. The PEEM insights into the MRE requires a re-examination of prior empirical analysis. This paper also incorporates detailed adjustments related to asset allocation that allow for more detailed estimates of both pension asset risk and pension liability risk. The empirical analysis of cost of capital estimates is also sensitive to broader PBO estimates of pension liability risk implied by PEEM and subsequently endorsed by US GAAP (SFAS 158), relative to the more narrowly defined ABO measure that estimates the minimum liability that firms must bear in an event of default, which is implied by EM and former US GAAP (SFAS 87).

The empirical results concerning the association of pension risk to firm risk are much more equivocal than those reported by JMB and are also sensitive to variations in pension asset and liability values and risk under various cases. In addressing the full theoretical implications of PEEM, this paper further considers the impact of mergers or consolidation of NDB plans and by extending the concept of firm risk and pension risk to incorporate various elements of idiosyncratic risk. These subtle changes as a result of apparently minor variations have a significant impact on the magnitude, relative weighting, and risk implications of any inference about the relation of firm risk to pension risk. The baseline empirical results are robust to alternative specifications of these risks and corroborative tests are also consistent with those of the broader literature which find a positive association between idiosyncratic risk and stock returns in the presence of high degrees of agency costs in the form of insider ownership.

The empirical results should be treated with caution where it has applied the one-period standard CAPM, and consequently, issues concerning duration and multi-period impact of value changes in financial and/or business risk on various operating, financial, and pension components of the firm have not been addressed.²³ This paper has also not considered the broader impact on idiosyncratic risk of other firm strategies related to derivative usage or other sources of transferable capital. These remain issues for further research. Furthermore, in seeking to replicate the environmental conditions applicable to

the original JMB study, this study has not decomposed the various types of NDB and their incremental and relative importance in affecting the overall cost of capital estimates that evolved over the subsequent two decades since the research was originally undertaken. Additionally, there are strategic managerial issues related to the shifting of risk from the firm to employees in times of economic uncertainty which may mitigate the impact of pension funds on a firm's cost of capital (Cumming et al. 2024). Furthermore, there are issues concerning the cross-sectional variation between firm risk, pension plan asset allocation, and the credit rating and funding policy of pension plans (Rauh 2009). These and other issues are left as issues for future research.

Subject to these caveats, this paper finds that the extent of overestimation because of omitting pension value and risk is less than what prior researchers imply. This paper also finds that there are systematic variations in the association of pension risk and firm value for firms with implicit contracts and those with explicit contracts. Sources of idiosyncratic risk appear to explain the relation of pension risk to firm risk, especially for firms that terminate their defined benefit pensions. Finally, our findings suggest that altering the mix and magnitude of value and risk components of pension assets and liabilities can affect the cost of capital and pension risk. Our analysis also bears upon standard models used to explain the cross-section of stock returns, since unfunded pension exposure appears to be important for many firms.

The paper also has identified a number of practical implications for financial analyst professionals and regulators. In particular, it has identified the importance of NDB arrangement in both conditioning and supplementing well-known standard cost of capital applications that are not identified in the professional literature (e.g., Pratt et al. 2014). The primary contributions of the paper are the following:

- (1) It is important to control alternative measurement bases for defined benefit pension liabilities that incorporate salary growth assumptions that firms now recognize on their balance sheets, i.e., beyond the previously reported spinoff termination value (ABO). Specifically, current GAAP requires firms to report the broader PBO, which includes wage growth assumptions. Both the ABO and PBO make restrictive assumptions about the explicit and short-term nature of DB employment contracts. A broader EBO or long-term funding measure of pension liabilities is conceptually more consistent with a long-term asset pricing or returns model. However, the estimated cost of capital increases as the DB pension liability measure broadens from an ABO to a PBO estimate of the pension liability.²⁴
- (2) Any analyst estimating a firm's WACC should adjust explicitly for various sources of firm risk management strategy (e.g., O'Brien 2006), and such procedures should be sufficiently robust to more clearly delineate the categories of 'net operating assets' from 'net financial liabilities'.
- (3) Cost of capital estimates should also be sufficiently precise in modeling details of a firm's pension asset allocation to enable more reliable and robust inferences to be drawn concerning the predicted relationship between pension risk and firm risk, allowing for both DB and NDB plans.
- (4) It is important to adjust WACC estimates for the purposes of 'fundamental value' analysis by separating the impact of 'implicit contracts' with employees, arising from the recognition of (i) salary growth assumptions (PBO vs. ABO) and the (ii) avoid 'double counting' problems by separating the interests of both diversified external investors and non-diversified employee stock investors that participate in pension plans with significant investments in parent company stock.
- (5) The adjustment procedures suggested in (1) to (4) above are particularly relevant to those examining the explanatory power of Fama and French (1992) three-factor plus momentum models, and especially in examining the cross-section of returns of significantly underfunded firms.

This paper proposes a simple set of procedures for estimating the cost of capital that incorporates both systematic and non-systematic sources of pension risk. By considering

the debt and equity implications, our analysis suggests that standard procedures underestimate these risks. Further research can address these issues even more comprehensively by examining broader inter-relationships between various retained and transferred risk sources which are often off-balance sheet contingent claims.

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Appendix A

Proof of Equation (4). If the values of both DB and NDB plans are included, then the estimated operating asset is

$$\widehat{NOA} = NOA = E + NFL - NPA_{DB} - NPA_{NDB} - OPT$$

The estimated operating asset beta becomes

$$\widehat{\beta}_{NOA} = \frac{E}{NOA}\beta_E + \frac{NFL - NPA_{DB} - NPA_{NDB}}{NOA}\beta_{NFL} - \frac{OPT}{NOA}\beta_{OPT}$$

Define $\widehat{\varepsilon}_{NOA} = \widehat{\beta}_{NOA} - \beta_{NOA}$

$$\begin{aligned}\widehat{\varepsilon}_{NOA} &= \frac{E}{NOA}\beta_E + \frac{NFL - NPA_{DB} - NPA_{NDB}}{NOA}\beta_{NFL} - \frac{OPT}{NOA}\beta_{OPT} \\ &- \left(\frac{E}{NOA}\beta_E - \frac{NFL}{NOA}\beta_{NFL} \right) - \left(\frac{PA_{DB}}{NOA}\beta_{PA_{DB}} - \frac{PL_{DB}}{NOA}\beta_{PL_{DB}} \right) - \left(\frac{PA_{NDB}}{NOA}\beta_{PA_{NDB}} - \frac{PL_{NDB}}{NOA}\beta_{PL_{NDB}} \right) - \frac{OPT}{NOA}\beta_{OPT} \\ &= \frac{(PA_{DB} - PL_{DB}) - (PA_{NDB} - PL_{NDB})}{NOA}\beta_{NFL} + \left(\frac{PA_{DB}}{NOA}\beta_{PA_{DB}} - \frac{PL_{DB}}{NOA}\beta_{PL_{DB}} \right) + \left(\frac{PA_{NDB}}{NOA}\beta_{PA_{NDB}} - \frac{PL_{NDB}}{NOA}\beta_{PL_{NDB}} \right) \\ &= \frac{PL_{DB}}{NOA}(\beta_{NFL} - \beta_{PL_{DB}}) + \frac{PA_{DB}}{NOA}(\beta_{PA_{DB}} - \beta_{NFL}) + \frac{PL_{NDB}}{NOA}(\beta_{NFL} - \beta_{NDB}) + \frac{PA_{NDB}}{NOA}(\beta_{PA_{NDB}} - \beta_{NFL})\end{aligned}$$

□

Notes

- ¹ Dhaliwal (1986) argues that financial leverage and fundamental risk should be separately incorporated into cost of capital estimates. Chen et al. (2008) finds that fundamental risk affects the cost of capital estimates. This paper, therefore, calculates net financial liabilities and net operating assets using the definition in the standard financial analysis literature.
- ² The United Nations, International Labour Organisation, and the Principles for Responsible Investment have also recognised the increasing prominence of labor and social issues for corporate responsibility reporting, through the establishment of a new “TaskForce for Social Related Financial Disclosures”, which has yet to formally issue international guidance on this issue.
- ³ SEC amendment to 101(c) of Regulation S-K, US listed companies require “a description of a registrant’s human capital **resources**, including any human capital measures or objectives that the registrant focuses on in managing the business” (Securities and Exchange Commission 2020). The SASB’s Human Capital Management Research Project (Sustainability Accounting Standards Board 2020) states that “Human capital is a critical element of the SASB standards. As a thematic issue, it is the second most prevalent issue across the SASB standards, second only to climate risk”.
- ⁴ Previts (1974) subsequently identified Sprague as having an important impact on subsequent professional and academic thinking on the relation of liabilities and proprietorship equity.
- ⁵ This study follows Forker (2000) with the PEEM and EM models because it relates more clearly to alternative accounting treatments of equity-based employee compensation and for analyzing its implications for the estimating the impact of alternative pension accounting treatments of the reporting entity, including the all-equity model.
- ⁶ A 401K plan permits employees to elect to have a portion of their compensation contributed to a qualified retirement plan (Employee Benefits Retirement Institute 2009). Investors in 401K plans issued by Lucent Technologies sued based on the Employee Retirement Income Security Act (ERISA) of 1974, which states that plan sponsors have a fiduciary responsibility to provide prudent and diversified investing options. However, it does not impose any upper restrictions on the amount of company stock that a 401K plan can invest in.

- 7 Himmelberg et al. (2002) derive a model whereby cost of capital, capital structure, and ownership concentration are endogenous variables.
- 8 The Employee Benefits Research Institute (Employee Benefits Retirement Institute 2011a) reports that participation in defined contribution plans (which promise a specified contribution to an employee's account) is growing faster than participation in traditional defined benefit pension plans (which promise a specified benefit at retirement). The percent of private-sector active-worker participants in a defined benefit plan where the defined benefit plan was the only plan that declined from 62 percent in 1975 to 7 percent in 2009, while the percent of private-sector active-worker participants in a defined contribution plan where the defined contribution plan was the only plan increased from 16 percent in 1975 to 67 percent in 2009. Employee Benefits Retirement Institute (2011b) also identifies significant increases in the average 401(K) plan accounts to 2009, except for 2008, with the bulk of assets invested in stocks, of which a significant (but declining) proportion is invested in the sponsoring company's own stock (Employee Benefits Retirement Institute 2011a).
- 9 Non-defined benefit plans (NDB) can vary widely and may range from post-retirement health care benefits (subject to US GAAP SFAS 106), to section 401K pension plans and other forms of retirement income savings, such as endowment funds, and employee stock options. For the purposes of this research, and simplicity of expositions, these different types of entity are consolidated these into a single term "NDB" although in practice, they widely significantly in contractual form.
- 10 It is recognised that the full range of deferred compensation arrangements are necessarily off-balance sheet in nature and asymmetric; hence the analysis reported is confined to direct company exposure to underfunded defined benefit plans and health care obligations, company own stock investments of 401K, and defined contribution plans.
- 11 This is one of the caveats acknowledged by JMB. Not being able to assign specific beta risk to each asset under a specific asset class may lead to some measurement error in their analysis.
- 12 This table is like Forker (2000) Table 5, but additionally includes the implications for the appropriate measure of the pension obligation.
- 13 This decomposition of the sample reflects the SIC itself, in which manufacturing sector firms (2000–4999) dominate. Sample manufacturing firms are further decomposed into industry sub-sectors: food and apparel (18), paper and publishing (39), chemical and petrol (66), rubber-glass and metal (24), equipment and machines (84); other (36).
- 14 Our measures of the ABO, PBO, and EBO are highly positively correlated, consistent with the simulation results of Selling and Stickney (1986) and are not reported here.
- 15 Bodie (1990) views pension funds as an insurance subsidiary. The pension promises are viewed as participating annuities that offer a guaranteed minimum nominal benefit determined by the plan's benefit formula. This guaranteed benefit is permanently enriched from time to time, at the discretion of management, depending on the financial condition of the plan sponsor, the increase in the living cost of retirees, and the performance of the fund's assets. Evidence in support of this 'guaranteed minimum' contention is the fact that many UK plans have given ad hoc benefit increases to plan participants in the past.
- 16 The optionality element inherent in pension commitments is introduced by Sharpe (1976), who focuses on the impact of the introduction of government pensions insurance in ERISA on the nature of an employer sponsors' pension obligations. However, he does not model an equivalent implicit contingent claim by employees on the pension fund surplus, which is the focus of the insurance view of pension contract.
- 17 Because the empirical analysis is focused on the post-disclosure period from 2006 to 2008 only, the study does not amend the CAPM estimates to reflect longer-run changes in risk factor loadings or learning-based approaches to estimate CAPM (e.g., Adrian and Franzoni 2009), although it is recognized that this may also bear on the validity of the model and findings. See the limitations discussion in the conclusion.
- 18 In the 'combination case', the highest quartile of firms with 'growth' are treated as (iii), the next quartile of firms with the highest estimated put options are treated as (iv); and firms with minimal pension exposure are treated as (i). The remainder are treated as (ii).
- 19 Further analysis of cost of capital estimates by industry 2-SIC code breakdown (not reported) shows that significant inter-industry variation in cost of capital estimates. The lowest sector is utilities, while the highest if retail. These results are consistent with the finding that incorporating risk and value of pension risk in utilities has little impact on their already structured balance sheets, whereas it has a more significant impact on more leveraged retail firms.
- 20 Curme and Kahn (1990) predict and find that, for a sample of US firms, the incidence of pension arrangements is significantly lower on average for distressed firms. These findings are consistent with the explanation that the failure to delineate relatively large S&P 500 firms that are more likely to have significant pension exposure may lead to the findings reported in JMB of a non-significant relation between pension risk and firm risk for their (much larger) sample of distressed US firms.
- 21 Decomposing results by whether firms terminate or continue DB pension plans is important because Bulow and Scholes (1983) argue that there is a separating equilibrium by which firms either have continuing or terminating contracts with their employees.
- 22 The definitions of control variables used in this paper are consistent with those employed by JMB to clarify the incremental explanatory power of alternative proxies and measurement bases of pension risk.
- 23 Stapleton and Subrahmanyam (1984) overview a taxonomy of alternative multi-period CAPM models that could be applied to overcome this issue. However, Fama (1977) demonstrated that the application of CAPM to multiperiod valuation is theoretically

valid. Application texts such as Pratt et al. (2014) outline the procedure for calculating discount rates based on changing business and-or financial risk over time.

24 We suspect this is a major reason why financial analysts prefer not to use the PBO for cost of capital estimation purposes.

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Article

The Impact of CEO Characteristics on Investment Efficiency in Jordan: The Moderating Role of Political Connections

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Abstract: This study investigates the impact of CEO characteristics—specifically CEO age, founder status, and family membership—on investment efficiency in Jordanian non-financial companies, with a focus on the moderating role of political connections. Drawing on the existing literature, we identify conflicting views regarding how these characteristics influence investment decisions. Some studies suggest that younger CEOs may adopt more aggressive investment strategies, while older CEOs tend to be conservative, leading to balanced resource allocation. Similarly, CEOs with founder status and family membership are thought to have an emotional attachment to the company, theoretically resulting in cautious investment behavior. However, empirical evidence remains mixed. By using data from 62 non-financial firms listed on the Amman Stock Exchange (ASE) from 2019 to 2023, this study employs regression analysis to explore these relationships. The findings reveal that CEO age contributes to investment efficiency by mitigating both over- and under-investment. Contrary to expectations, CEO founder status shows no significant effect on investment efficiency. Additionally, family-member CEOs exhibit a tendency toward under-investment, driven by a desire to preserve family wealth. Political connections further complicate these dynamics, encouraging riskier investment strategies while diluting the positive effects of CEO characteristics. These results provide new insights into the intricate interplay between CEO traits and political networks, contributing to the discourse on corporate governance in emerging markets. The study concludes with practical implications for policymakers and company boards, emphasizing the need for balanced leadership selection strategies to optimize investment efficiency.

Keywords: CEO characteristics; investment efficiency; founder status; family ownership; political connections; Jordanian companies

1. Introduction

Investment efficiency is a key concern in corporate finance, particularly in emerging markets such as Jordan, where companies must navigate complex economic, cultural, and political landscapes. Investment efficiency refers to how effectively a firm allocates its resources to maximize returns and support long-term growth. Despite its importance, the factors that enhance or hinder investment efficiency remain contentious. Recent studies on investment performance have emphasized the role of policy linkages in shaping corporate decisions. These studies argued that governance frameworks, regulatory policies, and CEO characteristics could impact investment efficiency (e.g., Smith et al. 2021; Kouaib et al. 2022). Moreover, the current literature identifies CEO characteristics—such as age, founder status, and family membership—as significant influencers of investment efficiency. However, the nature of these influences is still subject to debate, given the diverse and sometimes conflicting findings in this area (Xie 2015; Gan 2019; Ullah et al. 2020). Jordan's corporate

environment has a unique dynamic from those of developed economies. Companies are commonly owned by families and pronounce political affiliations that shape corporate governance and decision-making processes. In addition, the Jordanian market suffers from limited access to external capital, complex regulatory requirements, and recurring market fluctuations. This challenging environment establishes a distinct context within which factors influencing investment efficiency need closer examination.

Among the various CEO characteristics, age has been extensively examined for its impact on investment decisions. Some studies argue that younger CEOs are inclined to take more risks and adopt aggressive strategies, potentially leading to more efficient investments (Xie 2015; Gan 2019). However, this risk-taking tendency can sometimes result in over-investment and inefficiencies (Chowdhury et al. 2023). In contrast, older CEOs are often associated with a more conservative approach, favoring balanced resource allocation to reduce the likelihood of over- or under-investment (Lai et al. 2020). These conflicting perspectives highlight a need to explore how CEO age affects investment efficiency in specific cultural and economic contexts, such as that of Jordan.

CEO founder status introduces another layer of complexity. Founders often possess a deep emotional attachment to their company and a long-term vision for its success, which theoretically guides them toward cautious and efficient investment strategies (Meier and Schier 2021; Wang et al. 2022). Nonetheless, some research challenges this notion, suggesting that founders' strategies may change over time, leading to reduced investments in key areas such as research and development (Hsu et al. 2020). This inconsistency suggests that the influence of CEO founder status on investment efficiency is not yet fully understood, especially in the Jordanian market.

The role of CEOs who are family members in family-owned companies is another significant but under-explored factor in investment decision-making. Family-based CEOs often prioritize preserving family wealth and reputation, which can result in more cautious investment behaviors (Delgado-García et al. 2023). In Jordan, family businesses are known to focus on their reputation, shaping their approach to investments (Bataineh et al. 2018). Despite this, the literature has not comprehensively examined how the status of a CEO as a family member directly impacts investment efficiency in Jordanian companies. Addressing this gap is crucial for understanding how family influence affects corporate decisions in this region.

Political connections are also common in emerging markets such as Jordan. Thus, corporate decisions may be influenced by this connection in a positive or negative way. On the one hand, these connections can help companies access resources and overcome some regulatory challenges. On the other hand, they may create pressures that lead to poor investment decisions that deviate from the company's long-term goals. This dual role of political connections triggers an important question regarding how this factor can affect CEO decisions and their investment outcomes. Studying this interaction can provide a clear insight into the unique challenges in Jordan's business environment. Political connections further complicate the relationship between CEO characteristics and investment efficiency. In developing countries such as Jordan, political connections are often leveraged to access valuable resources, reduce financial constraints, and facilitate investment (Altarawneh et al. 2023). While these ties can provide competitive advantages, they may also encourage companies to pursue investments that do not align with long-term objectives, often leading to over-investment and inefficiencies (Ali et al. 2024). Therefore, examining how political connections interact with CEO characteristics is essential for a comprehensive understanding of investment efficiency in the Jordanian context.

Given these complexities and conflicting findings, this study aims to investigate how CEO characteristics impact investment efficiency in Jordanian non-financial companies. To achieve this purpose, the study relies on the UET and Agency Theory to explain how CEO characteristics and political connections interact to affect the level of investment efficiency in emerging countries such as Jordan. Additionally, it seeks to explore the moderating role of political connections in these relationships. By addressing these aspects, the research

provides a more nuanced understanding of how CEO traits and political networks shape investment decisions in an emerging market setting.

The upcoming sections of this study are structured as follows: the literature review delves into prior research on CEO characteristics and their impact on investment efficiency. This section also explores the role of political connections as a moderating influence on investment decisions. The methodology section outlines the research design, data sources, sample selection, and the variables used in the analysis. Following this, the results section presents empirical findings, highlighting the key relationships and interactions observed. The discussion interprets these findings in light of the existing literature, and the conclusion summarizes the study's contributions, practical implications, limitations, and suggestions for future research.

2. Literature Review

This study categorizes CEO characteristics into three main themes. The first discusses the role of CEO age to explore how CEO age can impact investment efficiency. The second section gauges how founder status can impact the company's investment decisions. Finally, we establish the status quo of recent studies about how family ownership can shape investment decisions. This section discusses how political connections can moderate this relationship.

2.1. CEO Age

Previous studies have shown that CEO age can impact investment efficiency in several ways and in several contexts. For example, Xie (2015) studied this issue in SOE Chinese companies and found that CEOs who are younger invest less but with greater efficiency than those who are older. They argue that the political ambitions of young CEOs play a major role in making more scrutinized decisions and resource allocations to enhance their investment outcome. A different but related view was shared by Gan (2019), who also found that CEO age can impact investment decisions. However, the authors argue that older CEOs are more prone to adopting a conservative strategy for investment, which leads to under-investment. In contrast, younger CEOs do not mind taking risks to make an effective investment decision. Both authors argued that younger CEOs are better at resource allocation and long-term company performance.

In recent years, more studies have examined similar issues. In this regard, Lai et al. (2020) studied CEO overconfidence and investment efficiencies at work. They found that the overconfidence of younger CEOs can lead to their applying more aggressive strategies related to labor allocation decisions. On the other hand, older CEOs adopt a more measurable approach to labor allocation. Hence, evidence suggests that overconfidence in younger CEOs can steer to over-investment. Therefore, Ullah et al. (2020) suggested a more balanced approach when dealing with top management. They explore CEO age and age diversity in boards of directors. The study found that age diversity can enhance investment decisions through this pool of ideas. This diversity creates a balance between the tendency of over- and under-investments that is caused by the different views and strategies.

Chowdhury et al. (2023) studied investment efficiencies based on three CEO characteristics, namely, power, age, and tenure. They found that CEOs with longer tenure have more power and are more oriented to over-invest. However, this overconfidence commonly results in a reduction in investment efficiencies. Moreover, this situation usually escalates when CEOs gain more power over time. Chowdhury et al.'s (2023) results contradict those of Gan (2019), arguing that older CEOs are more conservative when it comes to investment efficiencies.

In general, there is a lack of consensus regarding how CEO age can impact investment efficiency. These various results and dynamics suggest an absence of a clear directional relationship. However, it is also possible that cultural, economic, and political connections play a major role in shaping how CEO age merges this relationship.

To address this gap, the following hypothesis is proposed:

H1: *CEO age and founder status do not have a significant impact on investment efficiency for Jordanian non-financial companies listed in the ASE.*

2.2. Founder Status

CEO founder status occurs when a company's CEO is the founder or one of the founders of the company. Typically, the CEO founder status owns a substantial share of the company and is emotionally attached to it. They are also involved in shaping corporate culture and following long-term strategies for the company. Thus, CEO founder status captured research attention and its relation to CEO investment efficiencies. Prior studies have shown that firms that are led by their founder tend to have better performance in terms of environmental, social, and governance (ESG) when compared to other CEOs (Chowdhury et al. 2023). Moreover, CEO founders are more cautious about their investment decisions that reflect their social status. In doing so, companies' reputations and visibility are among their priorities (Meier and Schier 2021). Thus, it is expected that investments are directed toward firms' reputations and toward improving investment efficiencies. This view was shared and noted in various studies that found that CEO founders seek a long-term commitment to the firm and sustainable growth and efficiencies (Wang et al. 2022).

Despite this, other studies have shown that CEO founder status is not always efficient when it comes to CEO investment. For example, Hsu et al. (2020) found that CEO founders with longer tenures invest less in research and development than those with less tenure, causing a reduction in companies' innovations. On the other hand, the tenure of non-founder CEOs showed an inverted U-shaped relationship between investment and research and development. This result indicates that CEO founders change their strategies and behaviors over time.

In addition, Peng et al. (2023) argue that Taiwanese family-owned companies invest more efficiently when managed by their CEO founder or a family descendant. This behavior is well explained by the socioeconomic wealth theory, which assumes that family involvement in the business creates an emotional attachment and leads to long-term planning to pass the company heritage to the next generation. Similar behavior was also observed in Jordan. Bataineh et al. (2018) found that Jordanian family-owned businesses are highly protective of their reputation and tend to avoid earnings management behavior and the use of creative accounting. However, investment decisions have not yet been fully explored in this context.

Abebe et al. (2020) explored the role of CEO founder status in long-term decisions such as merging, acquisition, and development. They found that the existence of the CEO founder significantly impacts these types of decisions. Despite this result, the authors noted that investment decisions were also impacted by other internal and external factors, such as company age and size.

Kongkaew et al. (2022) investigated the impact of CEO founders and investment efficiency in the context of internationalization and IPO underpricing. Their study found that CEO founders are linked to greater IPO underpricing due to the investor's realization that higher risks are connected with their long-term involvement in the firm. This contrasts with the view that founder CEOs enhance investment efficiency, as underpricing reflects a perceived misalignment between the firm's value and its market potential.

To this end, there is a consensus that CEO founder status can play a major role in a company's investment decisions. CEO founders are conscious when making decisions that impact their companies in the long run. This usually leads to efficient investment after considering other external and internal factors. In Jordan, there is a lack of evidence regarding how CEO founders impact investment efficiency. Some factors, such as capital structure, family businesses, culture, and market conditions, could also impact this relationship. Therefore, we build upon prior research to investigate this issue by proposing the following hypothesis:

H2: *CEO founder status does not have a significant impact on investment efficiency for Jordanian non-financial companies listed in the ASE.*

2.3. CEO Family Business

A company is considered family-owned when one or more members of the family control the majority of shares in that company. On most occasions, the board of directors includes family members who are usually positioned at the top level of management. The family is also very active in strategic decisions and has vast control over the company. In addition, an interlink is usually found between ownership and management when the company is acquired by the family for the long term, and this privilege is passed on to the next generations. Much evidence suggests that family-owned businesses behave differently than other forms of business. This includes governance, risk assessment, investment efficiencies, and unique motivations related to their emotional attachment to the company.

Family-owned businesses have been extensively investigated in the prior literature. Family attachment is tackled differently in these studies, as it depends on the cultural construct of the family and whether the community is considered tribal or modernized. This diversity makes it very complex to find a consensus among researchers regarding how family businesses can impact company decisions. However, there is a general belief that the emotional attachment of the family to their company can lead them to make conscious decisions regarding the company's survival.

As for investment efficiency, Delgado-García et al. (2023) focused on two types of CEO effect: positive and negative. They examined the moderating role of family ownership structure on the impact of CEO effect and found that family CEO ownership and ownership within the family branch of the CEO can increase and intensify the effect of the CEO on research and development investment. These results indicate that positive family engagement in the company can result in better investment decisions and innovation within the Spanish context.

Similarly, García-Sánchez et al. (2020) found that the interaction between family businesses and external CEOs can enhance investment decisions. External CEOs can create a balance between the family's tendency toward investment decisions and the CEO being risk-averse, which results in balanced investments that are neither intensified nor exaggerated.

In fact, the family tendency toward investment in research and development has been captured in many contexts. Zulfiqar et al. (2021a) confirmed this by finding that family-owned businesses show overconfidence regarding projects related to innovation. Wei and Chen (2022); Chen and Huan (2022) also confirmed and extended this result by finding that family-owned businesses have more product innovation, while dispersedly owned companies are more innovative in processes and SOPs. This result supports the argument that family-owned businesses direct their investments toward long-term goals and achievements, while dispersedly owned companies tend to focus on short-term goals that reduce costs and maximize short-term benefits.

H3: *Family-based CEO ownership does not have a significant impact on investment efficiency for Jordanian non-financial companies listed in the ASE.*

2.4. Political Connections

Political pressure is another important factor that usually influences market dynamics, especially in developing countries. In recent years, the post-pandemic era has witnessed an increase in developing country debt and exerted intense pressure on their economy. Thus, governments have been subjected to acute economic austerity policies that aim to maintain the status quo of their economy and sustain the currency value. This severe pressure had a profound effect on the economy, leading to several decisions that were not always in the companies' favor. Moreover, high political figures in these countries are usually ideal for

holding positions on the company's board of directors. This exchange usually results in the company gaining a political network that can facilitate their work.

Accordingly, political connections occur when the CEO of the company or members of the board of directors have an established relationship or affiliation with high political figures or governmental institutions. This relationship can facilitate the company's access to information, contracts for government resources, and favorable treatment. Henceforth, this competitive advantage of risk management and reduced uncertainty can create more opportunities for investment efficiency. On the other hand, political connections can have a disastrous effect on the company, as political figures can pressure the company to enter projects that are not fully aligned with the company's vision. Altarawneh et al. (2023) found that companies with political connections are keener to over-invest and have high agency costs that focus on short-term benefits rather than long-term investment. In addition, when family businesses are involved with political connections, they have shown a low level of accounting conservatism and governance (Mohammed et al. 2017). Moreover, Supatmi et al. (2022) strengthened this view, as they found that politically connected and family firms see a decrease in financial position and performance.

Almarayeh et al. (2023) argued that, in Jordan, companies that have high political connections show weak performance caused by inefficiencies and corruption, even with a strong board of directors; this dynamic is very important in Jordan, as a political connection network is spreading around the firms, and companies do rely on this to access resources.

On the other hand, Dewiruna et al. (2020) argued that political connections in Indonesia can positively affect investment decisions in research and development, leading to better performance. Burt and Oppen (2020) found that political connections can positively support entrepreneurship through continuity; however, they found similar results to those of Altarawneh et al. (2023), where older firms with political connections focus on short-term benefits rather than long-term investment.

In general, there is a consensus that political connections can reduce company performance and lead to investment inefficiencies. Companies usually over-invest to gain short-term benefits at the cost of the long run. Accordingly, we further investigate this influence by proposing the following hypothesis:

H4: *Political connections do not have a moderating effect on the relationship between CEO characteristics and investment efficiency in Jordanian non-financial companies listed in the ASE.*

3. Methodology

This study used all Jordanian non-financial firms listed on the Amman Stock Exchange (ASE). The total study sample consisted of 62 firms and covered the period from 2019 to 2023. The years were chosen to capture recent economic conditions impacting Jordanian companies. Thus, this timeframe reflects regulatory shifts, economic challenges, and market volatility due to the COVID-19 pandemic, which created a unique economic environment influencing corporate investment decisions. Firms in the financial sector were omitted from the sample, as their regulatory environment and financial reporting requirements differ substantially from those of non-financial firms. Data were collected from the ASE website and consisted of annual reports and financial statements that were cross-checked for consistency and completeness. The study's variables are listed in Table 1.

Table 1. The study's variables.

Var.	Definition	Data Source
INVEFF	The absolute value of residuals derived from the McNichols and Stubben (2008) model, measuring deviations in investment efficiency.	ASE, Annual Reports
OVER_INV	The value of residuals derived from the McNichols and Stubben (2008) model if the residual is positive (indicating over-investment).	ASE, Annual Reports
UNDER_INV	The value of residuals derived from the McNichols and Stubben (2008) model if the residual is negative (indicating under-investment).	ASE, Annual Reports
CEOAGE	The natural logarithm of CEO age during the year.	Annual Reports
FOUNDER	A dummy variable that takes the value of 1 if the CEO is the company founder and 0 otherwise.	Annual Reports
FAMILYBUS	The percentage of shares owned by family members.	Annual Reports
PCON	A dummy variable that takes the value of 1 if the firm is politically connected and 0 otherwise.	Public information, ASE
SIZE	The natural logarithm of the total assets.	ASE, Annual Reports
ROA	The ratio of net income to the total assets.	ASE, Annual Reports
LEV	The ratio of total debts divided by the total assets.	ASE, Annual Reports
BDSIZE	The total number of directors on the board.	Annual Reports
FIRMAGE	The natural logarithm of the number of years since the firm's incorporation.	ASE, Annual Reports

4. Measurement

The hypotheses about the impact of CEO family ownership and political connections on the efficiency of investment were tested using a method similar to that of McNichols and Stubben (2008). Accordingly, we estimated excess investment as the deviation of the actual investment from the predicted investment based on firm-level characteristics, individually considered for each industry and year to control for industry-specific investment patterns.

Investment efficiency (INVEFF) was measured using the residuals derived from the McNichols and Stubben (2008) model, with the absolute value of residuals transformed into the negative. This unconventional interpretation is adopted because lower values indicate closer alignment between actual and expected investments, suggesting greater efficiency. Positive residuals (OVER_INV) indicate over-investment, while negative residuals (UNDER_INV) indicate under-investment. Moreover, considering the previous literature, two investment efficiency measures (INVEFF1 and INVEFF2) were also used to test the robustness of the results. INVEFF1 and INVEFF2 are different ways of measuring investment efficiency by varying the underlying assumptions or segmenting the data in different ways. Using these two measures ensures that the results are not 'model-dependent' (that is, they are not dependent on the specific ways of defining investment efficiency) and are consistent across different specifications of investment efficiency, thereby increasing confidence that the results are accurate.

$$INV_{i,t} = \alpha_0 + \beta_1 CF_{i,t} + \beta_2 GROWTH_{i,t-1} + \beta_3 INV_{i,t-1} + \epsilon_{i,t}$$

where

- $INV_{i,t}$ represents the investment level for firm i in year t ;
- $CF_{i,t}$ is the firm's cash flow in year t ;
- $GROWTH_{i,t-1}$ is the firm's growth in total assets from year $t-2$ to year $t-1$;
- $INV_{i,t-1}$ is the firm's lagged investment from the prior year.

Investment efficiency is the absolute value of the residuals transformed into the negative. Higher negative values are indicative of greater efficiency. Over-investment is measured when the residuals are positive, and under-investment is measured when

the residuals are negative. This strategy allows us to capture both the over- and under-investment behaviors of firms in Jordan and to see how CEO characteristics, family ownership, and political connections affect them. In addition to the core regression models, there are interaction terms for the moderating effects of political connections. Based on the unique characteristics of Jordanian firms, some of them had to be entered as interaction terms with other variables in the regression models.

5. Regression Model

For the hypotheses related to CEO age, CEO founder status, family-based CEO ownership, and political connections, we used a cluster regression, with fixed effects of year and industry, to test whether being a Jordanian non-financial firm has any effect on these variables. To account for potential endogeneity and autocorrelation within firms, the analysis employed a clustering method at the firm level. This approach groups standard errors by firm to mitigate within-firm correlations over time, thus providing more robust results. By clustering standard errors, the study reduces bias from unobserved, firm-specific effects that may influence investment efficiency. Accordingly, we used descriptive statistics to present the findings and conducted pair-wise correlations and univariate differences (between the samples) to check for the normality of the distribution and homoscedasticity; we tested the regression using the *t*-test. Additionally, we utilized the Heckman test to check the robustness of the model and account for the possibility of sample selection bias. To ensure the robustness of the regression model, we conducted a multi-collinearity test using the VIF for all independent variables; the results indicated no severe multi-collinearity issues. Heteroskedasticity was also tested using the Breusch–Pagan test, and any detected heteroskedasticity was addressed by applying robust standard errors to improve the reliability of coefficient estimates. Additionally, autocorrelation was checked using the Durbin–Watson test, and adjustments were made as necessary to account for serial correlation within the panel data. Afterward, we confirmed that the regression model is appropriately specified and satisfies key statistical assumptions, supporting the validity of the results.

The basic specifications for testing the hypotheses were as follows:

$$\text{INVEFF}_{it} = \alpha_0 + \beta_1 \text{CEOAGE}_{it} + \beta_2 \text{FOUNDER}_{it} + \beta_3 \text{FAMILYCEO}_{it} + \beta_4 \text{PCON}_{it} + \beta_5 \text{SIZE}_{it} + \beta_6 \text{ROA}_{it} \\ + \beta_7 \text{LEV}_{it} + \beta_8 \text{BDSIZE}_{it} + \beta_9 \text{FIRMAGE}_{it} + \theta_1 - n\text{Fixed\_effect}_{it} + \text{eit}$$

where

- INVEFF is the investment efficiency;
- CEOAGE is the natural logarithm of CEO age;
- FOUNDER is a binary variable that takes the value of 1 if the CEO is the founder of the firm or 0 otherwise;
- FAMILYCEO is a binary variable for family CEO status (1 if the CEO is a family member or 0 otherwise);
- PCON is a binary variable representing political connections (1 if the firm has political ties or 0 otherwise);
- SIZE is the natural logarithm of the total assets;
- ROA is the return on the assets (net income/total assets);
- LEV is the leverage ratio (total debts/total assets);
- BDSIZE is the number of directors on the board;
- FIRMAGE is the natural logarithm of the number of years since the firm's incorporation;
- Fixed_effects include year- and industry-fixed effects;
- eit is the error term.

As was the case for Bae et al. (2017), Biddle et al. (2009), and Cheng et al. (2013), we also controlled for firm-level factors that might affect investment efficiency, such as firm size, return on assets, leverage, board size, and firm age.

6. Empirical Results

Table 2 presents the descriptive statistics for the variables used in the study. The table depicts the measures of CEO characteristics, investment efficiency, and other control variables across Jordanian firms.

Table 2. Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
OVER_INV1	0.021	0.036	0.000	0.420
UNDER_INV1	−0.036	0.021	−0.063	0.000
INVEFF	−0.035	0.022	−0.210	0.000
CEOAGE	55.71	5.99	40.2	68.7
FOUNDER	0.181	0.385	0	1
FAMILYCEO	0.198	0.105	0	1
PCON	0.4814	0.4995	0	1
SIZE	7.238	0.633	6.88	7.591
ROA	0.032	0.116	−0.2	0.0205
LEV	36.469	28.524	1.891	50.589
BDSIZE	7.728	2.26	6	9
FIRMAGE	26.786	15.787	6	62

Table 2 shows the descriptive statistics for the variables used in the model and provides a summary of the characteristics of the sample firms. The variable denoting the overall level of over-investment (OVER_INV1) has a mean of 0.021 and a standard deviation of 0.036, reflecting moderate variability in the level of over-investment across firms (with a minimum of 0.000 and maximum of 0.420). The variable denoting the overall level of under-investment (UNDER_INV1) has a mean of −0.036, reflecting the fact that some firms tend to under-invest (with a minimum and maximum of −0.063 and 0.000, respectively). The overall measure of investment efficiency (INVEFF) has a mean of −0.035, implying that firms tend to have negative residuals (with a standard deviation of 0.022, reflecting variability between actual and expected levels of investment).

The average CEO age (CEOAGE) is 55.71 years, with a range of 40.2 to 68.7 years, which indicates that most of the CEOs, on average, are in the late part of their career. The variable CEO founder status (FOUNDER) indicates that 18.1% of the CEOs are the founders of a firm, and 19.8% are members of a family (FAMILYCEO), which is not surprising given the nature of family firms. Political connections are not uncommon, as 48.14% of firms have political connections, suggesting that political factors could play an important role in the sample.

7. Regression Results

Table 3 presents the results of the cluster regression analysis, which examines the impact of CEO characteristics, firm attributes, and political connections on investment efficiency. The analysis focuses on over-investment (OVER_INV1) and under-investment (UNDER_INV1) decisions to determine how factors such as CEO age, founder status, family CEO status, and political connections influence firms' tendencies to deviate from optimal investment levels.

The results of the regression for over-investment (OVER_INV1) and under-investment (UNDER_INV1) indicate how firm-specific, CEO characteristics, and political connections affect the efficiency of investment. In the over-investment model, the coefficient for CEOAGE is negative and significant (-0.034 , $p < 0.01$), meaning that older CEOs are less likely to engage in over-investment. In other words, the predicted effect of age (experience)

and probably the risk aversion associated with it ('experience curse') can lead to wiser investment decisions. Similarly, in the under-investment model, CEOAGE is negative and significant (-0.028 , $p < 0.01$), implying that older CEOs are also less likely to engage in under-investment, likely because of experience and, hence, better resource allocation.

Table 3. Cluster regression results.

DV	OVER_INV1	UNDER_INV1
Intercept	0.062 ** (2.560)	−0.135 *** (−7.789)
CEOAGE	−0.034 *** (−3.210)	−0.028 *** (−4.902)
FOUNDER	0.002 (0.678)	−0.007 (−0.642)
FAMILYCEO	0.003 (0.932)	0.010 ** (2.290)
PCON	0.027 *** (3.901)	−0.012 *** (−2.673)
SIZE	0.003 ** (2.411)	0.007 *** (3.874)
ROA	0.038 *** (5.012)	0.064 *** (6.513)
LEV	0.022 *** (4.110)	0.014 *** (3.271)
BDSIZE	−0.001 (−0.789)	−0.003 (−0.901)
FIRMAGE	−0.004 (−1.321)	−0.009 * (−1.841)
Fixed Effects	Included	Included
Adj. R ²	0.41	0.38
N	1240	1240
F-stat	6.154	28.942

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

FOUNDER is positive and significant in the under-investment model (0.014 , $p < 0.01$) and is not significant in the investment efficiency model, which is surprising, as it suggests that being a founder does not have an inherent impact on investment efficiency. However, FAMILYCEO is positive and significant in the under-investment model (0.010 , $p < 0.05$) and, again, insignificant in the investment efficiency model, which suggests that firms run by family-member CEOs are more likely to under-invest. It is plausible that this reflects a conservative approach to investment, with family members prioritizing the preservation of family wealth over aggressive expansion.

Political connections (PCON) are included in both models. The coefficient for PCON is positive and significant at the 1% level in the over-investment model (coefficient of 0.027), meaning that political connections increase the likelihood of over-investment, whether via easier access to financing or because these firms are simply granted investment permissions in excess of optimal levels. In the under-investment model, PCON is negative and significant at the 1% level (-0.012), suggesting that political connections help to reduce under-investment, perhaps by removing financial constraints.

The control variables (SIZE, ROA, and LEV) are statistically significant in both models. The positive coefficients for SIZE and ROA reveal that larger and more profitable firms are more likely to both over- and under-invest, which is consistent with the more complicated investment behaviors of large and successful firms. The positive relationship with LEV indicates that debt levels and investment inefficiency are interconnected, with higher levels of leverage being positively associated with inefficient investment, perhaps as a result of the pressure of debt servicing.

The adjusted R-squared values for the over-investment and under-investment models are 0.41 and 0.38 , respectively, and so the models account for most of the variability in investment inefficiency. The F-statistics are highly significant and support the validity of the regressions.

These findings underline the important role of CEO age and political ties in investment decisions. The positive effect of political ties on over-investment and the negative effect on under-investment shows the ambiguous role of political ties in corporate governance and allocation of resources. To look more in-depth into these dynamics, the next level of analysis introduces the moderating role of political connections. This will help us to understand how political ties affect the relationship between CEO traits, family ownership, and investment efficiency.

Regarding firm characteristics, the average firm size (SIZE; logarithm of total assets) is 7.238, with a small standard deviation, which indicates that the sample firms are quite similar in size. Return on assets (ROA) has a mean of 0.032, but its large standard deviation (0.116) indicates substantial differences across firms regarding profitability. Leverage (LEV) has an average of 36.47%, which is quite high and indicates that many firms depend on debt to finance activities. The board size (BDSIZE) has an average of 7.73 members, and the average firm age (FIRMAGE) is 26.78 years, which indicates that we are dealing with mature firms with well-established governance mechanisms in place.

8. Moderating Effect

The results of the regression shown in the Table 4 below reveal that there are several significant relationships between CEO characteristics, family ownership, and investment efficiency, with political connections as a moderating factor. As with the previous results, CEO age (CEOAGE) remains a significant determinant of investment efficiency, positively affecting overall efficiency (INVEFF) and reducing both over- and under-investment inefficiencies. The negative coefficients of over- and under-investment suggest that older CEOs are more risk-averse and better attuned to long-term firm value.

Table 4. Regression estimates regarding the effect of CEO characteristics, family ownership, and politically connected firms on investment efficiency.

DV	INVEFF	OVER_INV1	UNDER_INV1
Intercept	−0.215 *** (−8.712)	0.091 *** (3.254)	−0.129 *** (−6.841)
CEOAGE	0.028 ** (2.512)	−0.041 ** (−3.220)	−0.019 *** (−5.361)
PCON	0.020 * (1.764)	−0.052 ** (−2.654)	−0.037 *** (−4.452)
PCON*AGE	−0.014 *** (−3.721)	0.014 ** (2.427)	−0.010 ** (−2.314)
FOUNDER	0.002 (1.014)	0.002 (0.644)	−0.003 (−0.698)
FAMILYCEO	0.008 * (1.943)	0.010 ** (2.213)	0.008 ** (2.571)
PCON*FOUNDER	−0.017 ** (−3.601)	0.013 ** (2.431)	−0.009 *** (−3.114)
PCON*FAMILYCEO	−0.013 *** (−3.762)	0.011 ** (2.601)	−0.010 *** (−3.321)
SIZE	0.002 ** (2.311)	0.004 *** (3.732)	0.005 ** (2.731)
ROA	0.036 *** (5.312)	0.046 *** (5.812)	0.068 *** (6.911)

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Political connections (PCON), which are weakly positive in the main investment efficiency model, are very strongly negative with both over-investment (OVER_INV1) and under-investment (UNDER_INV1). This suggests that politically connected firms make poorer investment decisions. This is in line with our expectations that political ties result in poorer investment outcomes through inefficiencies due to political rent-seeking.

The interaction terms tell a more interesting story. PCON*AGE has a negative effect on aggregate investment efficiency and under-investment but a positive relationship with over-investment. Political connections mitigate the positive effect of older CEOs on efficiency, especially by reducing the effect of their risk aversion and leading them to pursue riskier over-investment strategies.

Consistent with this interpretation, the interaction terms PCON*FOUNDER and PCON*FAMILYCEO also indicate under-investment and negative impacts on investment efficiency while increasing over-investment. The results suggest that politically connected family firms and founder-led companies are more inclined to over-invest, thereby diminishing the otherwise beneficial role of family ownership in the efficient allocation of resources.

Control variables continue to play a role via SIZE, ROA, and LEV across the models, which serves to highlight the importance of firm size, profitability, and leveraging in shaping investment efficiency. Larger firms have better resource access and show a natural resilience against under-investment, while firms with high ROA demonstrate effective operational efficiency, supporting optimal investment levels. Leverage can also restrict or pressure firms into efficient investment choices due to debt obligations and can influence investment efficiency outcomes. We also note that political connections become a moderating variable that unveils how external political forces interact with internal leadership attributes to shape investment efficiency in Jordanian firms. The results here show that political connections introduce more complexity into investment decisions, including through shaping over-investment behaviors that could diminish overall efficiency.

9. Discussion and Conclusions

This study aimed to explore the impact of CEO characteristics on investment efficiency for Jordanian companies. Furthermore, the study also explored political connections as a moderator for this relationship.

To achieve this purpose, we ran several regression models to explore these relationships covering the period from 2016 to 2023 in Jordanian ASE companies. The first two models explored CEO investment decisions and whether they tend to under- or over-invest. We found that older CEOs maintain an even-handed approach regarding investment decisions, as they are less likely to engage in over-investment decisions and also mitigate under-investment. This can be explained by the assumption that older CEOs are more experienced and follow risk-averse strategies. Likewise, we believe that older CEOs are better at resource allocation skills, which is considered to have a beneficial influence on the companies in the long run. Accordingly, the findings indicate that older CEOs, with their conservative and balanced resource allocation approaches, positively impact long-term investment efficiency. This suggests that firms seeking sustainable growth may benefit from experienced leadership that emphasizes careful investment strategies. On the other hand, family CEOs prioritize wealth preservation, indicating that family-owned firms might adopt more risk-averse policies that could limit aggressive expansion. Contrastingly, younger CEOs tend to pursue aggressive and innovative investment strategies. Similar results were captured by Xie (2015) and Gan (2019), who found that younger leaders often drive higher efficiency in emerging markets. However, Chowdhury et al. (2023) argued that there are risks of overconfidence among younger CEOs, leading to over-investment.

In contrast to our expectations, CEO founder status does not have any effect on investment efficiency or decisions regarding over- or under-investment. This result shows that founders do not have a substantial influence over companies' decisions regarding investment. We also found that family member CEOs are engaged in under-investment decisions. The results support the view that family member CEOs are keener to preserve their wealth rather than following aggressive expansion. Finally, our results confirm the prior finding that political connections can impose pressure on companies to over-invest beyond their optimal level. In addition, we found that political connection reduces under-investment by elevating financial constraints.

The second main result of this research confirmed that political connections moderate the relationship between CEO characteristics and investment efficiency. CEO age, founder status, and family member CEO status are all negatively affected by political connections through decisions that encourage riskier and over-investment strategies. Moreover, we found that political connections can dilute the positive effect that resulted from CEO age and family member CEO status. Political connections exhibit a dual influence by moderating

the effects of CEO characteristics on investment efficiency. While they mitigate under-investment by easing financial constraints, they also heighten over-investment tendencies, particularly when interacting with CEO characteristics such as age and family member status. This dual effect complicates decision-making, where political ties might dilute the benefits of experienced or family member CEOs by encouraging high-risk, sub-optimal investments that align more with political objectives than with firm growth.

The first key result of this study supports the hypothesis that younger CEOs improve the efficiency of investment in Jordanian companies, which is consistent with Xie's (2015) and Gan's (2019) empirical findings that younger CEOs tend to make more aggressive and efficient investments in developing and emerging markets. However, it is opposite to the findings of Chowdhury et al. (2023), where younger CEOs are more overconfident and may over-invest. The adaptability and innovative thinking of younger CEOs in Jordan seem to outweigh the risk of overconfidence, which has a positive effect on improving investment efficiency in Jordan's specific socioeconomic environment.

In addition, the effect of CEO founder status on investment efficiency is expected to enhance investment efficiency through long-term commitment and strategic alignment (Guenzel and Malmendier 2020; Peng et al. 2023). However, our results did not support this view in Jordan.

Moreover, our result is in line with those found by Delgado-García et al. (2023) and Zulfiqar et al. (2021b), who stated that family businesses usually have a greater tendency to protect family wealth, rather than going for aggressive and risky investment strategies. The conservative investment policy can protect the family interests, but it can also undermine the firm's ability to take advantage of the growth opportunities and, hence, reduce the investment efficiency of the firm.

Lastly, the study's exploration of political connections as a moderating factor reveals that political ties exert a double impact on investment efficiency. As discussed earlier, political connections can facilitate and hinder investment decisions. The results here show that while political connections mitigate under-investment by providing firms with easier access to capital, they also increase the likelihood of over-investment. This is in line with what Altarawneh et al. (2023) observed, which is that political connections tend to result in over-investment in sub-optimal projects. Moreover, the interaction of political connections with family ownership and founder status further exacerbates over-investment tendencies and undermines the positive effects of these leadership and ownership arrangements. Together, these findings indicate that political connections render investment decisions inefficient in Jordan by encouraging politically motivated investment projects that are riskier and less likely to yield good returns. This double effect complicates the governance and resourcing processes in Jordanian firms, indicating that political ties are short-term facilitators that lead to long-term inefficiencies.

As in all research, this study is subject to several limitations. The first is that the focus was only on non-financial firms listed on the Amman Stock Exchange (ASE). Thus, the results lack external validity for other segments of the market, such as SMEs or unlisted family firms. Secondly, the 5-year period (2019–2023) is also insufficient to capture longer-term investment efficiency trends in industries with longer capital cycles or when subjected to important regulatory changes. Moreover, the timeframe of this study includes the global COVID-19 pandemic, which may influence corporate investment behaviors. Hence, the results should be interpreted carefully, as they may not fully represent periods unaffected by pandemic-related economic disruptions. Thirdly, we relied on a binary variable to capture the presence of political connections, which might underestimate the subtle and nuanced role that these ties play in corporate governance and investment decisions. Finally, the regression models used in this study do not provide sufficient evidence of causation. Hence, the results should be interpreted carefully before any generalizability attempt.

Despite these limitations, the study reveals several results that provide insights into Jordanian firms and policymakers regarding the role of CEO characteristics on investment decisions and relevant considerations to improve governance or leadership selection.

Theoretically, this study enhances the UET and agency theory by explaining how CEO characteristics and political connections interact to affect the level of investment efficiency in emerging countries such as Jordan. Moreover, the study also broadens the existing literature on the corporate governance of political connections by determining the effects of these factors on firm resource allocation in developing economies.

Future research can strengthen the generalizability of these results by expanding the scope of the analysis to include other sectors, especially SMEs. In addition, future studies could examine the impact of CEO age, founder status, and political connections by using more refined measures for political connections (for example, the strength or type of political ties). Moreover, researchers can explore the extent to which external governance mechanisms, such as independent directors or regulatory reforms, can mitigate the adverse effects of political connections and family ownership on investment decisions. Finally, studies that recognize other factors, such as organizational culture, management practices, and external economic shocks, could also relate this to investment efficiency. The current study did not include those factors in the model despite their potential influence on corporate decision-making. Hence, future studies can improve the current model by introducing these factors.

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Article

Does Profitability Moderate the Relationship Between the Leverage and Dividend Policy of Manufacturing Firms in Nigeria and South Africa?

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Abstract: This study examines the moderating role of profitability in the relationship between leverage and dividend policy in listed manufacturing firms in Nigeria and South Africa. Using a sample of 915 firm-year observations from 2013 to 2022, the analysis employs panel Tobit regression to manage the censored nature of dividend data, with logistic regression applied as a robustness check. The findings reveal a negative association between leverage and dividend payout ratio for Nigerian firms, while this association is less pronounced and statistically insignificant in South Africa, reflecting a more flexible financial environment. Profitability strengthens the leverage–dividend policy relationship in Nigeria, enabling firms to maintain dividends despite high leverage; however, this moderating effect is weaker in South Africa. These results underscore the importance of context-specific financial strategies, recommending that Nigerian policymakers improve access to affordable credit, while South African policymakers focus on sustaining market stability. This study advances the understanding of dividend policy in emerging markets by clarifying how leverage and profitability interact to shape dividend practices.

Keywords: dividend policy; leverage; profitability; emerging markets; manufacturing firms

1. Introduction

Corporate dividend policy remains one of the most debated topics in finance, owing to its intricate relationships with firm performance, leverage, and broader corporate governance frameworks. Dividend policy is a strategic decision that determines the timing, amount, and method of profit distribution to shareholders (Barros et al. 2022, 2023). Beyond being a channel for shareholder value creation, it serves as a signal of financial health while also reflecting inherent tensions in resource allocation between reinvestment for growth and returns to investors (Arhinful and Radmehr 2023). These tensions are particularly pronounced in emerging markets, where economic volatility, access to finance, and regulatory inconsistencies further complicate dividend policy decisions. This complexity is particularly evident in Nigeria and South Africa, which represent contrasting yet complementary contexts for studying dividend policy. Nigeria's developing financial market and resource-driven economy provide insights into dividend policy in environments with significant financial constraints, while South Africa's more advanced and well-regulated financial system offers a benchmark for comparison.

Understanding these dynamics raises critical research questions, including the following: How do leverage and profitability influence dividend policy in Nigeria and South

Africa? What is the relationship between leverage and dividend policy in listed manufacturing firms in these two countries? And does profitability play a moderating role in this relationship? Addressing these questions is crucial, given the strategic importance of dividend policy in emerging markets.

Existing theories offer varied perspectives on the underlying mechanisms that drive corporate dividend policy. Agency theory suggests that dividends mitigate agency conflicts by reducing excess cash, which might otherwise fund inefficient projects (Jensen and Meckling 1976). This dynamic is especially relevant in highly leveraged firms, where debt holders and shareholders contend for access to the firm's cash flows. Meanwhile, pecking order theory (Myers and Majluf 1984) emphasises firms' preference for internal financing over debt, positing that profitable firms rely less on external funding and thus enjoy greater flexibility in distributing dividends when sufficient resources are available. Signalling theory (Ross 1977) further explains that firms use dividends to convey stability and profitability to investors, a tactic particularly beneficial in emerging markets where information asymmetry can cloud investor perceptions.

In Nigeria and South Africa, these theories find nuanced application given the market volatility, regulatory constraints, and governance challenges. Manufacturing sectors in both countries face high leverage and costly access to capital, factors that influence their dividend policies (Adelegan et al. 2021; Ahmad et al. 2018; Bello and Lasisi 2020). South Africa's financial market, characterised by greater regulatory stability and maturity, contrasts sharply with Nigeria's, where firms operate under more resource constraints and face higher financial volatility. These differences make the comparison of Nigeria and South Africa particularly compelling, as it highlights how diverse institutional, economic, and governance environments shape dividend policy strategies. Motivated by these dynamics, this study aims to address three objectives: (1) to examine how profitability influences dividend policy, (2) to evaluate the relationship between leverage and dividend policy, and (3) to explore how profitability strengthens the leverage–dividend policy relationship, offering a comparative analysis between Nigeria and South Africa.

Despite the relevance of these theoretical frameworks, a significant gap persists in the empirical literature regarding profitability's moderating role in the relationship between leverage and dividend policy in emerging markets. Existing studies present mixed findings, with some suggesting that profitability enhances a firm's ability to balance leverage and dividends, while others report varying results depending on the economic context (Adelegan et al. 2021; Ahmad et al. 2018; Anggoro and Yulianto 2019). This inconsistency highlights the need for further investigation, particularly in regions like Africa, where diverse economic and regulatory environments could influence these dynamics. Addressing this gap, the current study examines how profitability, measured as return on assets (ROA), moderates the leverage–dividend policy relationship in Nigerian and South African manufacturing firms. Specifically, it focuses on the role of profitability in shaping this relationship, with the debt-to-assets ratio (DAR) serving as the primary measure of leverage.

This study addresses three critical gaps in the literature. First, it provides new empirical evidence on the moderating role of profitability in the leverage–dividend policy relationship within emerging markets, focusing specifically on the African context. While previous studies, such as those by Al-Najjar and Kilincarslan (2016) and Komrattanapanya and Suntraruk (2014), have examined profitability's direct impact on dividend policy, its interaction with leverage—particularly as a stabilising factor in volatile markets—remains underexplored. This study bridges this gap by analysing how profitability, measured by return on assets (ROA), influences dividend behaviour in manufacturing firms operating in Nigeria and South Africa.

Second, this study undertakes a comparative analysis of Nigeria and South Africa, two countries with distinct economic structures, regulatory frameworks, and corporate governance systems. This comparative approach highlights how differences in financial development, market maturity, and institutional settings shape dividend policies (Adelegan et al. 2021; Ahmad et al. 2018). While Nigeria represents a more resource-constrained and

regulatory-challenged environment, South Africa offers insights from a relatively more developed financial market. By juxtaposing these two economies, this study reveals the extent to which country-specific factors influence firms' ability to manage leverage and dividend payouts, adding to the existing literature by Setiawan et al. (2023) and Anggoro and Yulianto (2019).

Third, this study addresses methodological limitations in prior research by employing Tobit regression, which is well suited for handling censored dividend data. In many emerging markets, firms often limit or completely forgo dividend payments due to financial constraints, making standard regression techniques less effective in capturing the underlying relationships. By using Tobit regression alongside logistic regression for robustness checks, as recommended by Al-Najjar and Kilincarslan (2016) and supported by Komrat-anapanya and Suntraruk (2014), this study provides a more accurate and reliable analysis of the leverage–dividend policy nexus. These methodological advancements contribute to a deeper understanding of dividend behaviour in contexts where financial constraints are prevalent.

In sum, this study explores the interplay between profitability, leverage, and dividend policy in Nigeria and South Africa, using a robust methodological approach that includes Tobit regression to account for censored data and logistic regression as a robustness check. It contributes to the literature by highlighting the nuances of financial strategy in emerging markets, emphasising the importance of profitability in shaping dividend policies. Furthermore, it offers actionable insights for corporate policymakers and financial strategists in African markets, providing practical strategies for managing leverage and dividend payouts under capital constraints and economic volatility.

The remainder of this paper is organised as follows. Section 2 provides a review of the relevant literature and formulates the hypotheses. Section 3 describes the methodology, covering data sources, sample selection, variable definitions, and econometric models. Section 4 presents the empirical results alongside the robustness checks and discusses the key findings. Finally, Section 5 concludes with a summary of the findings, policy implications, limitations, and recommendations for future research.

2. Literature Review and Hypothesis Development

2.1. Profitability and Dividend Policy

Profitability allows firms to meet operational requirements and distribute returns to shareholders, often leading to increased dividend payouts. The relationship holds particular significance in emerging economies such as Nigeria and South Africa, where unique challenges including market volatility, regulatory frameworks, and financial constraints influence corporate financial decisions.

Agency theory suggests that dividend payouts decrease agency costs by restricting the free cash flow accessible to managers, thereby aligning managerial behaviour with the interests of shareholders. Dabboussi's (2024) study in Saudi Arabia demonstrates that enhanced profitability enables firms to manage leverage more effectively, thus securing resources for dividends that reduce potential agency conflicts. Profitability allows these firms to fulfil debt obligations and sustain regular dividend payouts, thereby establishing a direct connection between dividend policy and efficient resource allocation to enhance shareholder value.

Pecking order theory posits that profitable firms prioritise retained earnings over external financing for investment funding, thereby enabling more flexible dividend distribution. Empirical studies indicate that this preference contributes to dividend stability across various markets. Fama and French (2002) observed that profitable firms uphold stable dividend policies, indicating that profitability offers financial flexibility. DeAngelo et al. (2006) found that a high level of retained earnings in relation to equity facilitates stable dividend payments, which in turn enhances financial stability. This phenomenon is evident in emerging markets: Amidu and Abor (2006) demonstrated that Ghanaian firms with high ROA regularly paid dividends to indicate financial stability, even amid

competitive conditions. Similarly, Shyam-Sunder and Myers (1994) noted that profitable firms tend to distribute dividends due to their diminished dependence on external capital.

Signalling theory posits that dividends convey financial strength to investors, a crucial factor in markets characterised by significant information asymmetry. In these contexts, profitable firms frequently utilise dividend payments as a signal of stability. Rafique (2012) noted that profitable firms in emerging markets continue to distribute dividends despite underdeveloped financial conditions, indicating that such payments bolster investor confidence. Louziri and Oubal's (2022) study on the Casablanca Stock Exchange indicates that profitable firms maintained dividend payments even in adverse conditions, highlighting dividends as a marker of resilience. Lotto's (2020) study in Tanzania revealed that enhanced profitability resulted in higher dividends and strengthened investor confidence. Rochmah and Ardianto (2020) highlighted the significance of free cash flow in facilitating advantageous dividend policies, particularly in volatile markets. Based on this review, the first research hypothesis is constructed as follows:

H1. *There is a positive association between profitability and dividend policy in listed manufacturing firms in Nigeria and South Africa.*

2.2. Leverage and Dividend Policy

The interplay between leverage and dividend policy typically illustrates a balance aimed at reducing agency costs while addressing cash flow limitations. High leverage diminishes the excess cash accessible to managers, thereby constraining the likelihood of inefficient expenditures and aligning managerial behaviour with shareholder interests. Al-Najjar and Kilincarslan (2016) illustrate that in emerging markets, firms with high leverage prioritise debt obligations over dividend distributions to mitigate agency conflicts, reinforcing the idea that dividend payments may be reduced when debt servicing is required.

Additionally, firms typically favour financing investments via retained earnings instead of external sources, adhering to a financing hierarchy to reduce the costs associated with external funding. According to Frank and Goyal (2009), this preference indicates that firms with elevated leverage levels typically possess limited resources available for dividend distribution. Highly leveraged firms tend to decrease dividend payouts to conserve internal funds for debt obligations, consistent with the pecking order theory, which posits that firms distribute dividends only when surplus cash is present.

Evidence from Rahmawati and Narsa (2020) regarding Indonesian firms in the LQ45 index further supports this relationship. The findings indicate that leverage negatively impacts dividend policy, as firms prioritise debt repayment to ensure financial stability. The findings indicate that high leverage restricts dividend policy, especially in emerging markets characterised by elevated external financing costs, thereby reinforcing the inclination of leveraged firms to reduce dividend distributions.

In situations characterised by information asymmetry, particularly in emerging markets, dividends function as an indicator of financial stability. Firms with moderate leverage may utilise dividends to signal financial resilience to investors, as noted by Utami and Inanga (2011) in Indonesia. Le et al. (2019) report that Vietnamese state-invested enterprises utilise dividends to indicate strong future earnings, despite elevated leverage levels. This illustrates how dividends can convey a firm's stability and earnings potential, even in the presence of significant debt obligations.

The evidence from emerging markets indicates that high leverage typically compels firms to prioritise debt servicing over dividend distributions; however, dividends can still serve a strategic function in signalling stability when profitability permits. Considering these insights, we propose the subsequent hypothesis:

H2. *There is a negative association between leverage and dividend policy in listed manufacturing firms in Nigeria and South Africa.*

2.3. Profitability, Leverage, and Dividend Policy

Extensive research has analysed the individual relationships among profitability, leverage, and dividend policy; however, the moderating role of profitability between leverage and dividend policy is insufficiently explored, especially in emerging markets such as Nigeria and South Africa. The economic instability and governance challenges in these markets create a distinct context for analysing the impact of profitability on financial decisions. This research examines the relationship between profitability and its influence on the effect of leverage on dividend policy.

Empirical evidence supports the moderating role of profitability in the relationship between leverage and dividend policy. Al-Najjar and Kilincarslan (2016) found that profitable firms in emerging markets continue to distribute dividends even in the presence of high leverage ratios. Fosu (2013) observed that South African firms with higher profitability efficiently manage financial leverage and sustain dividend distributions. Similarly, Le et al. (2019) showed that profitable Vietnamese firms maintain dividend distributions even in the presence of high debt levels. The findings suggest that profitability may mitigate the constraining impact of debt on dividend policy; however, additional research is required to validate these dynamics in various contexts. Based on these findings, we propose the final hypothesis of this study as follows:

H3. *Profitability strengthens the relationship between leverage and dividend policy in listed manufacturing firms in Nigeria and South Africa.*

3. Methodology

3.1. Research Sample

The research sample consists of 915 firm-year observations of listed manufacturing firms in Nigeria and South Africa, covering a 10-year period from 2013 to 2022. The sample was carefully selected using a purposive sampling technique to ensure that only firms with complete and reliable financial data were included. This approach was essential for maintaining the integrity and robustness of the analysis, given the specific research focus on dividend policy, profitability, and leverage.

First, we only considered firms that have consistently listed on the Nigerian Exchange Group (NGX) or the Johannesburg Stock Exchange (JSE) throughout the study period. This ensured that the data reflected a continuous operational presence and minimised disruptions that could arise from firms entering or exiting the market. Second, this study focused exclusively on the manufacturing sector to provide consistency in the analysis and to account for sector-specific characteristics that may influence financial decisions. The manufacturing sector was chosen due to its significant contribution to economic activities in both countries and its relevance in leverage and dividend policy studies. Finally, firms were required to have published annual reports containing comprehensive financial information, including key metrics related to profitability, leverage, and dividend distributions. This criterion ensured the availability of consistent and detailed financial data across the sample.

The data were collected from a variety of reputable sources, including the official websites of the stock exchanges, firm annual reports, and recognised financial databases. These sources provided the necessary depth and accuracy for this study, facilitating a thorough and data-driven investigation into the relationships among the key variables.

3.2. Definition of Variables

Table 1 presents a summary of the variables employed in this study, encompassing their classifications, measurement techniques, and definitions. This table delineates the fundamental framework for examining the interrelations among dividend policy, leverage, profitability, and additional control variables within the research context.

Table 1. Definitions of variables.

Variable	Type	Measurement	Definition	References
Dividend Ratio (DPO)	Dependent	Ratio of total dividends paid to net income	Reflects the proportion of earnings distributed to shareholders. Used as a proxy for dividend policy.	Damodaran (2015); Rozeff (1982); Al-Najjar and Kilincarslan (2016)
DPO_binary	Dependent	Binary (1 if dividends paid, 0 otherwise)	Indicates if a firm paid dividends in a given year, enabling analysis of the likelihood of dividend payments.	Abdulkadir et al. (2016)
Debt-to-Asset Ratio (DAR)	Independent	Ratio of total debt to total assets	Represents the leverage by indicating the extent to which assets are financed by debt, reflecting leverage levels.	Jensen et al. (1992); Myers (1977)
Return on Assets (ROA)	Moderator	Ratio of net income to total assets	Measures a firm's profitability and operational efficiency, reflecting asset use for profit generation.	Akpadaka et al. (2024); Rasheed et al. (2023); Rehman and Takumi (2012)
Firm Size (FSIZE)	Control	Natural logarithm of total assets	Controls for the impact of firm size, as larger firms tend to have stable earnings and higher likelihood of dividend payment.	Holder et al. (1998); Nizar Al-Malkawi (2007)
Institutional Ownership (INSTOWN)	Control	Proportion of shares owned by institutional investors	Reflects corporate governance influences, as institutional ownership often relates to preference for consistent dividends.	Shleifer and Vishny (1997)
Asset Structure (AS)	Control	Ratio of fixed assets to total assets	Controls for the asset base, indicating financial flexibility, with higher fixed assets potentially impacting leverage/dividends.	Priyan et al. (2023)
Current Ratio (CR)	Control	Ratio of current assets to current liabilities	A liquidity measure assessing the firm's short-term financial health, influencing its capacity to pay dividends.	Akbar and Nurita (2022)
Revenue Growth (RG)	Control	Percentage change in revenue	Reflects firm growth rate, with high-growth firms more likely to retain earnings for expansion, impacting dividend policy.	Coulton and Ruddock (2011); Fama and French (2001)
Country Dummy (CTRY_DUM)	Control	Binary (0 = Nigeria, 1 = South Africa)	Accounts for country-specific effects, capturing differences in financial market, regulatory, and economic conditions.	Cox and Schechter (2019); Yip and Tsang (2007)

Note. Authors' compilation.

3.3. Research Models

This study uses six regression models to examine the relationships between leverage, profitability, and dividend policy, as well as how profitability interacts with leverage and dividend policy. We use panel Tobit regression as the primary model and complement it with a logistic regression model. These models are selected to appropriately address the characteristics of the data and the research objectives.

3.3.1. Panel Tobit Regression Model

The Tobit model is appropriate due to the censoring of the dependent variable, DPO. Firms may exhibit a dividend payout ratio of zero in instances where dividends are not distributed. This establishes a lower limit of zero, rendering ordinary least squares regression inappropriate because of possible biases and inefficiencies in parameter estimation. The Tobit model addresses censoring, facilitating more precise estimation of the relationships between dependent and independent variables (Nizar Al-Malkawi 2007; Singhania and Gupta 2012; Warganegara et al. 2020).

The panel Tobit regression model is specified as follows:

$$DPO_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 DAR_{it} + \beta_3 (ROA_{it} \times DAR_{it}) + \beta_4 FSIZE_{it} + \beta_5 INSTOWN_{it} + \beta_6 AS_{it} + \beta_7 CR_{it} + \beta_8 RG_{it} + \beta_9 CTRY\_DUM_{it} + u_{it} \quad (1)$$

In this model, DPO_{it} is the dependent variable measuring the dividend policy of firm i at time t , proxied by DPO. The explanatory variable measuring the leverage of firm i at time t is given by DAR_{it} . ROA_{it} is the moderating variable, and its interaction with the leverage variable ($ROA_{it} \times DAR_{it}$) is included to capture its moderating effect on the relationship between leverage and dividend policy. Control variables describe the characteristics of the firm at time t , and they are firm size ($FSIZE_{it}$), asset structure (AS_{it}), liquidity (CR_{it}), revenue growth (RG_{it}), institutional ownership ($INSTOWN_{it}$), and country dummy ($CTRY\_DUM_{it}$). Finally, u_{it} is the random error term for firm i at time t , accounting for unobserved firm-specific effects and idiosyncratic errors (Le et al. 2019; Le et al. 2019; Nguyen 2024).

3.3.2. Logistic Regression Model

The research employs a logistic regression model as a robustness check to examine the determinants of dividend policy, using the binary dependent variable DPO_binary as outlined in Table 1. This model examines the likelihood of dividend payments in connection with leverage, profitability, and the moderating effect of profitability. The logistic regression model is formulated as follows:

$$\text{logit}(P(DPO\_binary_i = 1)) = \alpha + \beta_1 DAR_i + \beta_2 ROA_i + \beta_3 (DAR_i \times ROA_i) + \gamma_1 FSIZE_i + \gamma_2 INSTOWN_i + \gamma_3 AS_i + \gamma_4 CR_i + \gamma_5 RG_i + \gamma_6 CTRY\_DUM_i + \varepsilon_i \quad (2)$$

In this model, $\text{logit}(P(DPO\_binary_i = 1))$ denotes the probability that firm i will pay dividends. The coefficients β_1 , β_2 , and β_3 show the effects of the DAR , the ROA , and how they interact with each other without taking the time effect into account. This regression model also incorporates the same set of control variables with that of the Tobit regression.

By using this logistic regression model as a robustness check, this study ensures that the findings from the panel Tobit regression are consistent and that the relationships between leverage, profitability, and dividend policy hold true even when analysed through a different methodological approach. This dual approach enhances the credibility and reliability of this study's conclusions, providing a comprehensive understanding of dividend behaviour across varying financial and market contexts (Barth and Clinch 2009; Petersen 2009; Wooldridge 2016).

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 presents the combined summary statistics of the variables for manufacturing firms in Nigeria and South Africa. The average DPO was 0.35, indicating a modest level of payouts relative to firm profits with substantial variation between firms (min = −33.03; max = 42.56). The binary representation of DPO (DPO_binary), which takes a value of 1 for DPO greater than 1 and 0 otherwise, had a mean of 0.049, highlighting that only a small proportion of firms distributed substantial dividends. ROA averaged 3.91%, ranging from −58.01% to 57.68%, suggesting significant variation in firm profitability. The DAR had a mean of 57.30%, indicating that firms in both countries used substantial leverage

in financing their assets. The average firm size (FSIZE) was 15.74, while institutional ownership (INSTOWN) was around 44.77%. The asset structure (AS), current ratio (CR), and revenue growth (RG) also displayed significant variation across firms, reflecting the diversity in firm operations and financial health in these emerging markets.

Table 2. Combined summary statistics of Nigeria and South Africa.

Variable	Observations	<i>M</i>	<i>SD</i>	Min	Max
DPO	915	0.3508	1.9801	−33.0271	42.5646
DPO_binary	915	0.0492	0.2164	0	1
ROA	915	0.0391	0.1028	−0.5801	0.5768
DAR	915	0.5730	0.2870	0.0998	3.3710
FSIZE	915	15.7354	2.2005	6.9470	21.2047
INSTOWN	915	0.4477	0.2793	0	0.9600
AS	915	0.3759	0.2131	0.0113	0.9578
CR	915	1.5861	1.3614	0.0239	19.2508
RG	915	0.2327	1.3187	−0.9504	20.3942

Note. Authors' compilation.

Tables 3 and 4 present the summary statistics for Nigerian and South African firms, respectively. Nigerian firms, on average, had a higher DPO of 0.48 compared to 0.21 for South African firms, indicating more frequent or substantial dividend payments among Nigerian firms. The binary representation, DPO_binary, was also slightly higher in Nigeria ($M = 0.057$) compared to South Africa ($M = 0.041$), which further supports the trend of more generous dividend payments by Nigerian firms. Nigerian firms also showed higher leverage, with a mean DAR of 63.00%, compared to 51.20% in South Africa. This suggests that Nigerian firms relied more on debt financing. Additionally, Nigerian firms had a larger average firm size and higher institutional ownership compared to South African firms. However, South African firms displayed a higher current ratio (CR) of 1.87, indicating stronger liquidity positions on average, and a slightly higher average revenue growth (RG).

Table 3. Summary statistics of Nigeria.

Variable	Observations	<i>M</i>	<i>SD</i>	Min	Max
DPO	473	0.4781	2.2424	−3.9808	42.5646
DPO_binary	473	0.0571	0.2322	0	1
ROA	473	0.0350	0.1127	−0.5801	0.5396
DAR	473	0.6300	0.3353	0.1242	3.3710
FSIZE	473	16.1766	2.3279	6.9470	21.2047
INSTOWN	473	0.5021	0.2841	0	0.9600
AS	473	0.4488	0.2279	0.0123	0.9578
CR	473	1.3217	1.3969	0.0239	19.2508
RG	473	0.2230	1.3093	−0.9422	20.3942

Note. Authors' compilation.

Table 4. Summary statistics of South Africa.

Variable	Observations	<i>M</i>	<i>SD</i>	Min	Max
DPO	442	0.2145	1.6456	−33.0271	4.6313
DPO_binary	442	0.0407	0.1979	0	1
ROA	442	0.0436	0.0909	−0.4196	0.5768
DAR	442	0.5120	0.2078	0.0998	2.9863
FSIZE	442	15.2632	1.9501	9.8684	19.4350
INSTOWN	442	0.3894	0.2620	0	0.9500
AS	442	0.2979	0.1635	0.0113	0.7182
CR	442	1.8690	1.2640	0.2172	11.4527
RG	442	0.2430	1.3301	−0.9504	16.4460

Note. Authors' compilation.

The descriptive statistics highlight that Nigerian firms tend to have higher dividend payouts, larger firm sizes, and more leverage than South African firms. However, South African firms exhibit better liquidity and revenue growth. These differences are indicative of diverse financial environments and corporate behaviours across the two countries, providing a basis for exploring how these characteristics affect dividend policy.

4.2. Correlation Analysis

Table 5 provides the correlation results for the combined dataset, which includes all sampled manufacturing firms from Nigeria and South Africa. The findings show several notable relationships. DPO and DPO_binary exhibit a moderate positive correlation of 0.326, suggesting that firms with higher dividend payouts are more likely to distribute significant dividends in absolute terms. ROA has a weak positive relationship with DPO ($r = 0.0596$), implying that more profitable firms tend to distribute higher dividends, although this relationship is not strong. The DAR does not have a strong relationship with the DPO ($r = 0.0046$), which suggests that leverage does not have a strong association with DPO across the whole sample.

Table 5. Combined correlation matrix of Nigeria and South Africa.

Variable	DPO	DPO_binary	ROA	DAR	FSIZE	INSTOWN	AS	CR	RG
DPO	1.0000								
DPO_binary	0.3264	1.0000							
ROA	0.0596	0.1654	1.0000						
DAR	0.0046	−0.0267	−0.4091	1.0000					
FSIZE	0.1305	0.1156	0.2614	−0.1279	1.0000				
INSTOWN	0.0108	0.0053	−0.0201	−0.0657	0.0745	1.0000			
AS	0.0445	−0.0434	−0.0787	0.1461	0.1602	0.1926	1.0000		
CR	−0.0822	0.0282	0.1433	−0.3510	−0.1679	−0.0405	−0.2442	1.0000	
RG	0.0099	0.0123	0.0183	0.0701	−0.0017	−0.0467	0.0054	0.0081	1.0000

Note. Authors' compilation.

FSIZE shows a weak positive correlation with DPO ($r = 0.1305$), indicating that larger firms are slightly more likely to pay dividends, which is consistent with the notion that larger firms typically have more stable cash flows, enabling them to sustain dividend payouts. The CR is negatively correlated with DPO ($r = −0.0822$), suggesting that firms with higher liquidity ratios tend to pay lower dividends, possibly due to a preference for maintaining internal reserves. INSTOWN and AS demonstrate minimal correlation with DPO, indicating that these factors may not directly influence dividend behaviour in the pooled sample of firms.

The country-specific correlation analyses (see Table 6 for Nigeria and Table 7 for South Africa) reveal differences in the relationships between variables, suggesting that the dividend behaviours may be influenced by country-specific factors such as financial regulations, market environments, and economic stability. In Table 5, the correlation results for Nigerian firms show a stronger positive relationship between DPO and DPO_binary ($r = 0.4110$) compared to the combined sample, suggesting that Nigerian firms that tend to pay dividends are more likely to make substantial payouts. The relationship between ROA and DPO in Nigeria ($r = 0.0736$) remains weak, indicating that profitability does not have a significant influence on dividend payouts in this country. Interestingly, the correlation between DAR and DPO in Nigeria is negative ($r = −0.0458$), implying that more leveraged firms tend to distribute lower dividends. This finding may indicate risk aversion in dividend policies among highly leveraged Nigerian firms.

Table 6. Correlation matrix for Nigeria.

Variable	DPO	DPO_binary	ROA	DAR	FSIZE	INSTOWN	AS	CR	RG
DPO	1.0000								
DPO_binary	0.4110	1.0000							
ROA	0.0736	0.1936	1.0000						
DAR	−0.0458	−0.0255	−0.5326	1.0000					
FSIZE	0.1305	0.1362	0.4064	−0.3596	1.0000				
INSTOWN	0.0119	0.0184	0.0721	−0.1764	0.1975	1.0000			
AS	0.0121	−0.1012	−0.1208	0.1006	0.0735	0.1341	1.0000		
CR	−0.0131	−0.0187	0.1352	−0.2728	−0.0932	0.0100	−0.2802	1.0000	
RG	0.0223	0.0330	−0.0638	0.1702	0.0275	−0.0977	0.0314	−0.0572	1.0000

Note. Authors' compilation.

Table 7. Correlation matrix for South Africa.

Variable	DPO	DPO_binary	ROA	DAR	FSIZE	INSTOWN	AS	CR	RG
DPO	1.0000								
DPO_binary	0.1797	1.0000							
ROA	0.0428	0.1263	1.0000						
DAR	0.0765	−0.0563	−0.1560	1.0000					
FSIZE	0.1011	0.0712	0.0707	0.1905	1.0000				
INSTOWN	−0.0257	−0.0306	−0.1327	0.0034	−0.1922	1.0000			
AS	0.0434	0.0094	0.0283	0.0313	0.1334	0.1320	1.0000		
CR	−0.1638	0.1133	0.1422	−0.4341	−0.1862	−0.0128	−0.0415	1.0000	
RG	−0.0063	−0.0125	0.1250	−0.0859	−0.0349	0.0127	−0.0245	0.0813	1.0000

Note. Authors' compilation.

In Table 7, the correlation results for South African firms highlight some differences compared to Nigeria. Specifically, the correlation between DPO and DAR is positive ($r = 0.0765$), suggesting that more leveraged South African firms are slightly more inclined to distribute dividends. This finding contrasts with the negative correlation found in Nigerian firms and could reflect differing attitudes towards risk management or varying access to external financing between the two countries. Additionally, the relationship between firm size and DPO is weaker in South Africa ($r = 0.1011$) compared to Nigeria, suggesting that firm size may play a lesser role in determining dividend payments in South African firms.

4.3. Regression Analysis Results

In this section, we present the findings of the regression analyses that aim to evaluate the impact of profitability, leverage, and control variables on the dividend policies of listed manufacturing firms in Nigeria and South Africa. As shown in Table 8, the regression models further explore the moderating role of profitability in the relationship between leverage and dividend policies.

Table 8. Compact summary of regression results for panel Tobit and logistic models.

Variable	Combined_XTT	NGR_XTT	SA_XTT	Combined_Logit	NGR_Logit	SA_Logit
ROA	−0.487 (2.548)	−12.857 (8.022)	2.482 *** (0.742)	6.018 (4.584)	−34.700 *** (8.947)	21.345 *** (5.529)
DAR	−1.303 ** (0.589)	−2.922 ** (1.242)	0.043 (0.185)	−0.213 (1.304)	−5.114 *** (1.682)	1.064 (2.359)
DAR_ROA	7.923 (4.123)	29.575 ** (13.753)	−0.037 (1.215)	1.573 (7.884)	69.530 *** (15.538)	−25.550 *** (9.673)
FSIZE	0.345 *** (0.060)	0.550 *** (0.116)	0.092 *** (0.015)	0.321 *** (0.093)	0.267 ** (0.104)	0.424 ** (0.185)

Table 8. Cont.

Variable	Combined_XTT	NGR_XTT	SA_XTT	Combined_Logit	NGR_Logit	SA_Logit
INSTOWN	−0.085 (0.331)	−0.443 (0.626)	0.096 (0.104)	0.121 (0.541)	0.483 (0.716)	0.132 (1.039)
AS	−0.167 (0.555)	−0.548 (0.958)	0.051 (0.163)	−1.829 ** (0.888)	−4.811 *** (1.561)	0.091 (1.494)
CR	0.056 (0.065)	0.040 (0.115)	0.083 *** (0.023)	0.131 (0.091)	−1.168 ** (0.507)	0.276 (0.153)
RG	−0.096 (0.087)	−0.066 (0.173)	−0.099 *** (0.034)	0.015 (0.099)	0.120 (0.115)	−1.029 (0.664)
CTRY_DUM	0.114 (0.256)			−0.166 (0.382)		
Intercept	−5.286 *** (1.099)	−7.650 *** (2.064)	−1.559 *** (0.275)	−8.153 *** (1.856)	−1.700 (2.495)	−11.613 *** (3.332)
sigma_u	0.827 *** (0.128)	1.129 *** (0.251)	0.000 *** (0.000)			
sigma_e	1.957 *** (0.059)	2.709 *** (0.115)	0.500 *** (0.022)			
rho	0.151 (0.041)	0.148 (0.057)	0.000 (0.000)			
Number of Observations	914	473	441	914	473	441
Rank of VCE	12	11	11	10	9	9
AIC	2824.192	1604.875	619.625	338.064	178.503	148.115
Pseudo R ²				0.113	0.225	0.135
F-Statistic	34.980	22.540	15.782			
Prob > Chi ²	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note. Authors' compilation. ***: $p < 0.01$; **: $p < 0.05$; no asterisk: not significant (standard errors are provided in parentheses).

4.4. Discussion

4.4.1. Profitability on Dividend Policy

The first hypothesis (H1) posited a positive relationship between profitability and dividend policy in listed manufacturing firms in Nigeria and South Africa. This section examines whether profitability influences firms' decisions to distribute dividends, which is critical in emerging markets where financial signalling plays a significant role.

The regression analysis for the combined sample of Nigerian and South African firms (Table 8) reveals a negative but statistically insignificant relationship between ROA and DPO (coefficient = -0.487 , $p > 0.05$). This suggests that, across both markets, firms with higher profitability do not necessarily increase their dividend payouts. This finding offers support to the pecking order theory, which posits that firms prefer to use internal funds for reinvestment rather than distributing them as dividends. Conversely, this finding contradicts signalling theory, which suggests that profitable firms use dividends to signal financial strength and stability to the market. Additionally, the finding challenges the Agency theory viewpoint, which posits that dividends serve as a mechanism to reduce agency conflicts by distributing excess cash to shareholders, thereby limiting managerial discretion.

For the Nigerian segment, the results reveal an insignificant negative relationship between ROA and DPO (coefficient = -12.857 , $p = 0.109$, as shown in Table 8). Given this statistical insignificance, it is difficult to definitively attribute the observed relationship to the pecking order theory. While the negative direction of the relationship aligns with pecking order expectations—suggesting that firms may prefer to retain earnings over distributing them—the lack of significance means that Nigerian firms may not consistently prioritise retained earnings for growth as theorised. This outcome partly aligns with Safiq and Yulianti (2023), who reported a significant negative relationship between ROA and dividend policy. In contrast, empirical research in other emerging markets, including studies by Amidu and Abor (2006) in Ghana and Arko et al. (2014) in sub-Saharan African nations,

has revealed a significant positive correlation between profitability and dividend payout. This suggests that more profitable firms in these areas tend to distribute higher dividends.

Conversely, South African manufacturing firms demonstrated a significant and positive association between ROA and DPO (coefficient = 2.482, $p < 0.01$, as presented in Table 8). This positive correlation aligns with signalling theory. In South Africa's more developed financial environment, profitable firms may sustain dividends to enhance investor confidence, aligning with findings by Lotto (2020) in Tanzania.

4.4.2. Leverage on Dividend Policy

The significant negative relationship between the DAR and DPO in the combined sample (coefficient = -1.303 , $p < 0.05$) aligns well with existing theory, lending support to Hypothesis 2 (H2), which posits a negative relationship between DAR and dividend policy in listed manufacturing firms in Nigeria and South Africa. The findings are consistent with the agency cost framework established by Jensen and Meckling (1976), who argue that agency conflicts can emerge when managers have discretionary control over free cash flow, potentially leading to inefficient or self-serving investments. Jensen (1986) further elaborates that high leverage reduces free cash flow due to the burden of debt servicing, thereby limiting the opportunity for managerial opportunism. Consequently, highly leveraged firms are inclined to adopt conservative dividend policies, prioritising debt repayment over shareholder distributions to align managerial incentives with the interests of both shareholders and creditors.

This theoretical explanation is especially relevant for Nigerian firms, where the negative impact of DAR on DPO is even more pronounced (coefficient = -2.922 , $p < 0.05$), strongly supporting H2. The financial environment in Nigeria, characterised by high borrowing costs and limited access to capital markets, demands stringent financial discipline. Here, the data suggest that highly leveraged Nigerian firms restrict dividend payouts to preserve cash for debt obligations, minimising agency conflicts and reflecting the practical necessity of efficient resource management. This behaviour corroborates empirical evidence from studies like Al-Najjar and Kilincarslan (2016), which emphasise the importance of debt management in emerging markets.

In contrast, the results for South African firms, where the relationship between DAR and DPO is insignificant (coefficient = 0.043 , $p > 0.05$), challenge the generalisability of Jensen's (1986) agency cost theory. The more developed and flexible financial markets in South Africa appear to mitigate the need for stringent financial discipline. This reduced agency concern may explain why high leverage does not significantly affect dividend policy, suggesting that South African firms face fewer constraints in managing debt and dividend payouts. The presence of better governance mechanisms and access to diverse financing options in South Africa likely play a crucial role, allowing firms to maintain a more balanced approach.

Therefore, while the findings for Nigeria support H2 and are consistent with the agency cost perspective, the results for South Africa indicate a more complex dynamic. In this context, other factors, such as signalling and financial market flexibility, may exert a more significant influence, reducing the pressure of agency concerns. This divergence underscores the importance of understanding market-specific conditions and the availability of alternative financial and governance mechanisms in shaping the leverage–dividend policy relationship.

4.4.3. Moderation of the Leverage and Dividend Policy Relationship by Profitability

This section tests Hypothesis 3 (H3), which posits that profitability positively moderates the relationship between leverage and dividend policy in listed manufacturing firms in Nigeria and South Africa. The combined model results reveal that the interaction term, DAR_ROA, has a positive coefficient of 7.923 but is not statistically significant ($p > 0.05$; Table 8). This suggests that, overall, profitability does not have a consistent or robust moderating effect on the leverage–dividend policy relationship when considering both

Nigerian and South African firms together. Consequently, it appears that firms, on average, do not heavily rely on profitability to manage the trade-off between debt obligations and dividend payouts in a unified context.

However, a more nuanced understanding emerges from the segmented analyses, which provide stronger support for H3. In the Nigerian segment (NGR_XTT), the interaction term, DAR_ROA, is highly significant and positive, with a coefficient of 29.575 ($p < 0.05$). This strong moderation effect indicates that profitability enhances the ability of Nigerian firms to manage high leverage while sustaining dividend distributions. It aligns with signalling theory, which suggests that profitable firms use dividends as a signal of financial stability, even in the face of substantial debt. This finding emphasises the crucial role of profitability in Nigeria's challenging financial environment, characterised by high borrowing costs and limited access to external financing. The results support H3, demonstrating that higher profitability enables Nigerian firms to meet their debt obligations while still rewarding shareholders—mitigating the adverse effects of leverage on dividend policy.

Conversely, the results for the South African segment (SA_XTT) show a negative coefficient of -0.505 for DAR_ROA, which is not statistically significant. This suggests that profitability does not significantly moderate the relationship between leverage and dividend policy in South Africa and may even have a slight weakening effect. The lack of significance implies that South African firms, operating in more developed and flexible financial markets, do not rely as heavily on internal profitability to maintain dividend payments. Instead, these firms may have more options for external financing, reducing the necessity for profitability to buffer the impact of high leverage on dividend decisions. This observation partially aligns with the pecking order theory, which highlights the prioritisation of internal over external financing.

These results underscore the contrasting roles of profitability as a moderating factor in emerging markets. In Nigeria, where financial constraints are more severe, profitability plays a critical role in enabling firms to manage leverage effectively while maintaining dividend payouts, which supports H3. This outcome illustrates the reliance on internal financial strength to balance debt and dividends in a constrained environment. In contrast, in South Africa, where firms benefit from more developed financial markets and access to diverse funding sources, the moderating role of profitability is less pronounced, reflecting a strategic difference influenced by market conditions and external financing options.

4.4.4. Effect of Control Variables on Dividend Policy

Table 8 also shows control variable analysis results, which help explain how firm characteristics affect DPO. Firm size positively correlates with DPO across all models. The coefficient for firm size is 0.345 ($p < 0.01$) in the combined model, 0.550 in Nigeria, and 0.092 in South Africa. This consistent significance suggests that larger firms pay higher dividends due to their financial stability and steady cash flow generation, which supports regular dividend distributions. Meanwhile, institutional ownership has no significant effect on DPO in any model, with coefficients of -0.085 in the combined model, -0.443 in Nigeria, and -0.096 in South Africa. This suggests that institutional ownership does not influence dividend policy in these markets. Similarly, no significant relationship exists between asset structure and DPO in all models, with coefficients of -0.167 in the combined model, -0.548 in Nigeria, and -0.051 in South Africa. It appears that a firm's asset composition does not influence dividend payouts in the contexts studied.

However, the current ratio shows a significant positive association with DPO in the South African segment only, with a coefficient of 0.083 ($p < 0.01$). Since they can distribute surplus cash without risking operational funds, South African firms with higher liquidity are more likely to pay dividends. The current ratio is not significant in the combined and Nigerian models, suggesting liquidity does not consistently influence dividend policy across markets. Furthermore, revenue growth has a substantial adverse relationship with DPO in South Africa, with a coefficient of -0.099 ($p < 0.01$), suggesting firms with higher revenue growth may prioritise reinvestment over dividend distribution. RG is not

significant in the combined or Nigerian models, indicating that revenue growth influences dividend policy differently across markets.

Finally, with a coefficient of 0.114, the country dummy variable in the combined model indicates no statistically significant country-specific effects on dividend policy for Nigeria and South Africa. This result suggests that nationality alone does not play a decisive role in shaping dividend policy decisions in these two countries. Instead, it points to the possibility that firm-level factors, such as leverage, profitability, and firm size, as well as broader macroeconomic conditions, are more critical determinants of dividend policy. The absence of a significant country effect highlights the convergence of certain financial practices across these emerging markets, possibly driven by globalisation, regional economic integration, or similar corporate governance frameworks. It also underscores the importance of understanding firm-specific and sector-specific dynamics when analysing dividend policy rather than relying solely on geographical distinctions.

4.5. Robustness Checks

To ensure the robustness of the main findings, logistic regression models were conducted using a binary form of the DPO (DPO_binary) as the dependent variable, as presented in Table 8. This section discusses the robustness results, focusing on the relationship between profitability, leverage, and dividend policy, analysed separately for the combined sample and the Nigerian and South African contexts.

In the combined logistic regression model, ROA remains positive but statistically insignificant, with a coefficient of 6.018. This indicates that, overall, profitability does not have a substantial direct impact on the probability of dividend payments when considering all firms together. The DAR remains negative and significant at the 1% level, with a lower coefficient of -0.213 , suggesting that leverage continues to reduce the likelihood of dividend payments. The interaction term (DAR_ROA) is positive but remains statistically insignificant, with a coefficient of 1.573, indicating that the moderating effect of profitability on the leverage–dividend relationship is not strong in the combined model.

In the Nigerian segment, ROA remains negative and is now statistically significant at the 1% level, with a large coefficient of -34.700 . This finding reinforces the negative relationship between profitability and the likelihood of paying dividends, suggesting that highly profitable firms in Nigeria prefer to reinvest earnings rather than distribute them as dividends, consistent with the pecking order theory. The DAR also remains negative and significant at the 1% level, with a reduced coefficient of -5.114 , indicating that leverage continues to have a strong, adverse effect on dividend policy.

The interaction term (DAR_ROA) in Nigeria remains positive and is now significant at the 1% level with an amplified coefficient of 69.530. This result highlights the strong moderating effect of profitability, suggesting that profitable Nigerian firms are better able to manage high levels of debt while still maintaining dividend payments, supporting the idea that profitability can alleviate the financial constraints posed by leverage.

In the South African context, ROA remains positive and statistically significant at the 1% level, with a coefficient of 21.345. This suggests that profitable firms in South Africa are more likely to pay dividends, aligning with the signalling theory, where dividends are used to indicate financial strength to investors. In contrast, the DAR remains positive but statistically insignificant, with an increased coefficient of 1.064, indicating that leverage does not significantly influence dividend policy in South Africa.

The interaction term (DAR_ROA) in South Africa remains negative and becomes statistically significant at the 1% level, with a coefficient of -25.550 . This finding suggests that the positive relationship between leverage and dividend policy is weakened by profitability, implying that highly leveraged but profitable firms in South Africa may prioritise financial stability over dividend payments, reflecting a more conservative approach to managing financial resources.

The logistic regression models demonstrate overall significance, as indicated by the $\text{prob} > \text{chi-squared}$ values of 0.0000 across all models. The Nigerian model has the highest

pseudo-R-squared value (0.225), suggesting that it explains dividend policy decisions more effectively than the combined model (0.113) and the South African model (0.135). Additionally, the Akaike information criterion values are lower for the country-specific models, suggesting a better model fit in these contexts.

Robustness checks confirm the key findings and reveal important nuances. In Nigeria, ROA remains negatively associated with dividend payments, now with stronger statistical significance, emphasising the preference for reinvestment over dividend distribution among profitable firms. Leverage continues to exert a negative influence on dividend policy, but the moderating effect of profitability is pronounced, allowing some firms to sustain dividend payouts despite high debt levels. In South Africa, profitability positively influences the dividend payout ratio, and the interaction between leverage and profitability becomes significantly negative, highlighting a more conservative approach to managing dividends.

5. Conclusions

This study provides a rigorous and comprehensive analysis of the factors influencing dividend policy among listed manufacturing firms in Nigeria and South Africa, focusing on the role of leverage and profitability. This study identifies distinct patterns and complexities in dividend policy management across these two economies. The findings reveal notable differences in how firms in these countries respond to financial leverage and profitability in shaping their dividend policies. In Nigerian firms, the stronger negative relationship between the debt-to-assets ratio (DAR) and the dividend payout ratio (DPO) highlights the acute financial constraints they experience. These constraints force firms to prioritise repaying debt over distributing dividends. Conversely, South African firms exhibit a less pronounced impact of leverage on dividend policy, reflecting a more developed financial market environment that offers greater flexibility in balancing leverage and shareholder returns.

Furthermore, this study demonstrates that profitability, measured by return on assets (ROA), plays a significant moderating role in the relationship between leverage and dividend policy in Nigerian firms. This indicates that higher profitability provides financial stability, enabling firms to sustain dividend payments even under high leverage. However, in South Africa, the moderating effect of profitability is weaker, suggesting that firms in a more advanced financial system rely less on internal profitability to support dividend distributions. These findings underscore the critical role of economic and institutional contexts in shaping corporate financial strategies in emerging markets.

This study also incorporates a robustness check through logistic regression analysis to examine the likelihood of dividend payments. This analysis reinforces the reliability of the results obtained from the Tobit regression model, confirming that the relationships among leverage, profitability, and dividend policy remain consistent across different methodological approaches. This methodological rigor enhances the credibility and robustness of this study's conclusions, making its insights valuable for both theory and practice.

Policy recommendations derived from this research are crucial for financial regulators and corporate managers in both Nigeria and South Africa. For Nigerian policymakers, this study emphasises the importance of improving access to affordable credit facilities to alleviate the financial pressures on highly leveraged firms and enable more balanced dividend policies. In South Africa, policymakers should focus on maintaining financial market stability and ensuring firms have access to diverse financing options to support strategic growth and shareholder value. Additionally, corporate managers in both countries should align their dividend strategies with their specific financial and operational contexts, particularly by leveraging profitability to effectively balance debt obligations and shareholder returns.

Despite similarities in the manufacturing sectors of Nigeria and South Africa, the operational and financial strategies differ significantly. Nigerian firms face greater financial constraints, requiring them to carefully manage their resources to meet both debt and equity

stakeholder expectations. In contrast, South African firms benefit from a more favourable financial environment, allowing for more flexible dividend policies. This study, therefore, emphasises that dividend policy formulation should be tailored to the unique financial, economic, and governance conditions of each country. These nuanced insights contribute to a better understanding of how financial environments shape corporate decisions in emerging markets.

However, this study has certain limitations that open avenues for future research. The focus on Nigeria and South Africa, while providing a rich comparative framework, may limit the generalisability of the findings to other emerging markets. The unique economic and financial structures of these countries highlight important dynamics, but extending the analysis to other African nations or developing economies could provide broader insights. Furthermore, the analysis does not explicitly address endogeneity issues such as omitted variable bias or reverse causality, which may influence the estimated relationships. Future research could employ advanced econometric techniques, such as dynamic panel models or the generalised method of moments (GMM), to address these issues and strengthen causal inferences.

This study's emphasis on manufacturing firms offers valuable sector-specific insights but limits the applicability of the findings to other industries. Investigating dividend policies across diverse sectors, such as technology, services, or natural resources, would provide a more comprehensive understanding of the determinants and dynamics of dividend decisions. Additionally, incorporating country-level variables, such as inflation, GDP growth, and financial market development indices, could provide deeper insights into how macroeconomic factors interact with firm-level determinants to shape dividend policy.

Lastly, the economic context of the study period, characterised by fluctuating market conditions and economic shocks, may affect the robustness of the conclusions over time. Incorporating year dummies or expanding the study period to capture longer-term trends could enhance the reliability of the findings. Moreover, future research could explore whether similar dynamics exist in other regions of Africa or among countries with varying levels of financial market maturity. Addressing these limitations and extending the scope of the analysis could significantly enrich the understanding of dividend policy in emerging markets.

Despite these limitations, this research provides valuable insights into how leverage and profitability influence dividend policy in Nigeria and South Africa. It highlights the importance of tailored financial strategies and offers actionable recommendations for policymakers and corporate leaders. By addressing the limitations, future research can refine and extend these insights, offering a more comprehensive understanding of dividend policies in diverse economic and sectoral contexts.

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Article

Financial Performance of the Target Companies: Before and After Acquisitions

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Abstract: This study investigates the financial performance of target companies involved in mergers and acquisitions (M&As), aiming to reveal the dynamics affecting these organizations pre- and post-transaction. Utilizing a comprehensive dataset, we analyze the financial outcomes of M&A deals globally, spanning from 2010 to 2019. Employing various financial ratios, such as liquidity ratios, profitability measures, leverage ratios, asset management ratios, and market valuation metrics, this research provides an understanding of how M&As influence the financial performance of target companies. The key findings suggest that target companies experience significant changes in their financial ratios post-acquisition, with liquidity and profitability ratios showing marked fluctuations. The study shows that the method of payment (cash vs. non-cash) and the size of the deal significantly influence the post-acquisition financial performance of target companies. Cash-based and lower-valued deals are found to have a more positive impact on financial stability and growth metrics. This research contributes to the existing body of knowledge by highlighting the marginal effects of acquisition strategies on target companies' financial performance. Our findings provide practical insights for potential acquirers, suggesting that the choice of acquisition method and deal size can significantly affect the financial outcomes of M&A activities.

Keywords: mergers and acquisitions; financial ratios; target companies; cash-based deals; non-cash-based deals

1. Introduction

The strategic decision to engage in mergers and acquisitions (M&As) is driven by the pursuit of growth, efficiency, and competitive advantage. As global markets evolve, understanding the financial outcomes of these transactions becomes paramount for scholars and practitioners alike. Despite the extensive body of literature exploring the multifaceted dimensions of M&As, the comparison of financial performances of target companies in the pre- and post-acquisition phases remains an area ripe for further investigation. This study aims to bridge this gap by analyzing the financial trajectories of target companies, shedding light on the implications of M&A transactions from a financial perspective. Additionally, we provide suggestions for potential acquirer companies on what makes a potential target company promising in transactions.

M&As, a pivotal aspect of corporate restructuring, serve as a means for companies to achieve economies of scale and scope, diversify their operations, avoid taxes, and enhance their market share. The literature in this domain is vast, encompassing various disciplines, such as economics, accounting, law, and finance, each offering unique insights into the motives, outcomes, and determinants of M&A success. Despite the abundance of research, the financial performance of target companies, especially in the aftermath of acquisitions, presents an intricate puzzle. Numerous studies have employed stock market performance

and accounting-based metrics to gauge the success of M&A transactions. Yet, the evidence about which metrics imply a successful acquisition remains inconclusive, with findings varying across methodologies, geographical regions, and industry sectors.

This study contributes to the existing literature by examining the financial performances of a significantly larger set of target companies compared to previous studies. Additionally, we adopt an extended analysis period spanning twenty quarters before the transaction, the transaction quarter itself, and eight quarters after the acquisition announcement. By employing sixteen financial ratios—a much broader scope than commonly used in prior research—this study offers a comprehensive evaluation of liquidity ratios, profitability measures, leverage ratios, asset management efficiency, and market valuation metrics. This robust approach provides a nuanced understanding of how M&A transactions impact the financial performance of target companies. The longitudinal methodology allows us to capture the dynamic financial performance of target companies, offering insight into the temporal effects of M&A transactions.

To the extent of our knowledge, our research is the first attempt at a comparative evaluation of target companies acquired with cash and those acquired with non-cash and target companies with low-valued deals and those with high-valued deals with respect to their financial statement data. By making this attempt, we aim to provide potential acquirers with a clearer understanding of what to expect when they consider acquiring a target company. In our analysis, we investigate mergers and acquisitions with respect to the type of payment that was chosen for the transaction and the size of the deal. These classifications allow us to delve into the financial implications of these transactions more deeply.

There are two main research questions in this paper. The first is whether acquirer companies should make payments in cash or non-cash. The second is whether acquirer companies should aim to acquire companies with smaller deal values or companies with higher deal values. We examine this problem by analyzing several financial ratios of target companies during the pre- and post-acquisition periods and evaluating whether cash or non-cash acquisitions, as well as high-deal-value or low-deal-value target companies, perform better financially in the post-acquisition period compared to the pre-acquisition period. Although an acquirer company's performance after an acquisition (Kusewitt 1985; Hitt and Pitano 2003; Savović 2016; Grigorieva and Petrunina 2015) or a target company's performance after an acquisition in terms of stock performance (Eckbo et al. 1990; Asimakopoulos and Athanasoglou 2013; Akben-Selcuk 2015) have been evaluated before, the financial performance of target companies in terms of financial ratios has not been examined. We expect that our research will provide insights for acquirer companies into which payment method to prefer, such as cash or non-cash, and whether to acquire companies with lower or higher deal values, considering the financial performances of target companies before and after acquisition.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature, highlighting the theoretical underpinnings and empirical findings related to the financial impacts of M&As. Section 3 describes the data and methodology, including the data collection process, selection of financial ratios, research design, and analytical techniques employed. Section 4 presents the results, followed by the final section, Section 5, which concludes with a summary of the study's contributions, limitations, and suggestions for future research.

2. Literature Review

The financial performance of M&As has been evaluated extensively in the literature for decades. However, a significant portion of the research focuses on stock market performance, utilizing the event study methodology and analyzing share price changes before and after acquisitions. Additionally, there is extensive research on the financial performance of acquirer companies in terms of financial ratios. On the other hand, the research on target companies is mainly limited to their stock performance.

Understanding the performances of target companies before and after acquisitions can provide valuable insights for acquirer companies in selecting targets that can be transformed into firms with improved liquidity, solvency, asset management, profitability, and market performance based on financial ratios. Therefore, we first analyze the literature from various perspectives, including stock market performance, success of acquirer companies, success of target companies, research on financial distress, and other studies that do not fit into these categories. Finally, we discuss our contribution to this body of research by addressing the gap in the literature.

Prior literature highlights the complex dynamics of M&A transactions, encompassing key thematic areas such as the role of CEOs, corporate governance, outcomes of M&As, and drivers of M&A decisions (Cumming et al. 2023). While the existing body of work has made substantial contributions to understanding these dimensions, certain areas remain underexplored or inadequately addressed. For instance, the literature provides robust insights into the predictive factors of takeovers, cross-border M&As, and antitakeover provisions but falls short of thoroughly examining the financial outcomes of target companies in terms of financial ratios pre- and post-acquisition. This gap underscores the need for a nuanced evaluation of how specific transaction characteristics—such as the method of payment and deal size—impact the figures provided in the financial statements of target companies.

Moreover, research on risk management, information asymmetry, and the legal environment has largely focused on acquirer companies, leaving a gap in the understanding of how these factors influence the post-acquisition financial performance of target firms. Similarly, the role of investor rights and learning in M&As, although well-documented for acquirers, has not been adequately extended to target companies.

This paper aims to bridge these gaps by focusing on the following two underexplored yet critical dimensions of M&A transactions: cash versus non-cash acquisitions and low-versus high-deal-value acquisitions. While the existing literature provides insight into the strategic considerations of payment methods and deal sizes, theoretical support for their specific impacts on target companies' financial performance remains limited. By analyzing a broader and more detailed set of financial ratios over an extended timeline, this study contributes to the emerging body of work that seeks to deepen our understanding of M&A dynamics from the target company's perspective.

2.1. Studies That Focus on Stock Market Performance

As a pioneer paper from the stock market performance analysis perspective, Halpern (1983) examines the literature concerning event study analysis by considering the methodological similarities and differences. The author evaluates the effectiveness of selected articles in explaining the rationale behind the analyzed mergers. Another paper by Eckbo et al. (1990), which uses the event study method, evaluates the cross-sectional models employed to estimate abnormal stock returns for 196 horizontal mergers that occurred between 1963 and 1981. The authors find that the benefits to acquirers decrease with acquirer size, industry concentration, and the number of previous acquisitions observed within the industry. On the other hand, the benefits for target companies increase with concentration and decrease with industry competition. Asimakopoulos and Athanasoglou (2013), in a study that analyzes stock market performance, evaluate the success of M&A transactions by analyzing the stock performance of European Banks that participated in M&A transactions between 1990 and 2004. Using the event study method, the authors find that the M&A transaction added value to the acquiring companies. More related to our work, target company performance is evaluated according to stock market performance by Akben-Selcuk (2015), who investigates the effect of Turkish mergers and acquisitions on shareholder wealth by analyzing the stock price performance of target companies. The author discovered that the positive cumulative abnormal return surrounding the announcement date benefited the shareholders of the target company.

2.2. Studies That Focus on the Success of the Acquirer Company

On the other hand, the success of acquirer companies in acquisitions is a widely researched topic. An early study by Kusewitt (1985) on acquirer companies' success examines the relationship between factors such as company size, ownership rate, and deal size and the long-term financial performance of acquiring companies. As a policy recommendation, the author states that the purchaser should pay lower premiums for long-term success, should prefer periods when the market is low in general, plan for a non-cash purchase, and pay attention to the growth potential and profitability of the target company. The author also recommends that the sectors of the target and acquiring companies should be related and that, especially, very small and very large purchases should be avoided, as well as deals requiring the payment of high premiums. In a similar way, with the priority of making policy recommendations for cross-border transactions, Hitt and Pitano (2003) compare M&A transactions with greenfield investments and strategic alliances as strategies for entering new markets. The authors point out that in order for acquisitions by companies from different countries to be successful, managers must have sufficient knowledge of the potential opportunities and challenges to be faced by the post-acquisition company. Savović (2016) measures the success of M&A transactions by a method that uses a combination of financial and non-financial performance indicators, which is called a hybrid. The author uses factors such as "development of new services or products", "service or product quality improvement", and "job satisfaction" in the performance evaluations. Savovic finds that company size is an important performance indicator of M&A success. S. R. Goldberg and Godwin (2001) critique the assumption that mergers inherently increase shareholder wealth, advocating for a comprehensive analysis with an economic value-added framework to assess whether mergers truly add economic value, amidst a shift toward shareholder-centric models in corporate governance. They emphasize the importance of diligent preparation, strategic evaluation, and post-merger integration to realize potential synergies and avoid the pitfalls that frequently undermine merger success.

There is also research that evaluates the success of both the acquirer and target companies. For instance, Altunbas and Marques-Ibanez (2004) measure the performance of cross-border M&A transactions in the EU banking sector by analyzing the financial ratios of banks. The authors find that bank mergers boost return on capital. In a study focusing on transactions in developing country, Grigorieva and Petrunina (2015) examine the economic profits of companies involved in M&A transactions in developing countries to determine the effects of M&A transactions on the performance of the companies involved. The authors conclude that M&A transactions reduce the value of the companies involved. Marks and Mirvis (2011) investigate the influence of the human element on the success or failure of the M&A process. Several research questions are posed by the authors in order to identify actions that increase the success rate of M&A transactions from a financial and human perspective. Masulis and Simsir (2018) examine the effects of target initiation in mergers and acquisitions. The authors discover that deal-initiating targets receive significantly lower premiums and deal-value-to-EBITDA multiples compared to other targets.

2.3. Studies That Focus on the Success of the Target Company

Although the dataset and/or financial ratios used are limited in most of them, papers on the financial performance of target companies also exist. For instance, in a narrow country-based study that uses a limited number of ratios, Akben-Selcuk (2008) examines pre- and post-acquisition accounting data of Turkish companies. Using industry-adjusted profitability ratios, the author concludes that the acquisition of Turkish target firms by foreign firms does not improve the performance of target firms. In a similar study, Arslan and Simsir (2014) evaluate the pre-acquisition and post-acquisition financial performances of target companies in M&A transactions in Turkey. The authors find that the operational performance of target firms was equivalent to their peers, while their stock performance was far superior to their counterparts. Using a model they developed, Phillips and Zhdanov (2013) determine the likelihood of a company being a target in an M&A transaction based on

the size of its research and development activities. Additionally, the authors demonstrate that the concentration of M&A transactions in a market fosters R&D and innovation. In related research, Lipeikyte (2015) investigates the effect of mergers and acquisitions on the post-merger performance of target companies, focusing on Baltic transactions. Following an M&A, the author observes an increase in the overall productivity of target companies. The author also discovers that target firms with relatively higher productivity prior to an M&A experience a more rapid increase in productivity during the post-merger period. In an interesting study, Bugeja (2015) investigates whether an acquisition is related to the financial tightness of the target company. The author emphasizes that target companies in financial distress receive relatively higher premiums from acquiring companies. The author also discovers a positive correlation between financial difficulty and purchasing competition, as well as a negative correlation between financial difficulty and purchasing success. Palepu (1986) proposes a model for predicting acquisition targets based on the logit probability function, as opposed to the typical procedure in the relevant literature, where a sample is drawn with a nearly equal number of targets and non-targets. The author examines the frequently tested hypotheses of inefficient management, growth–resource mismatch, industry disturbance, size, market-to-book, and price-earnings. Palepu discovers that their model is statistically significant, but its explanatory power is limited. Ambrose and Megginson (1992) extend Palepu’s model by incorporating insider and institutional shareholdings, as well as financial and asset structures. Akhigbe et al. (2004) identify variables associated with a bank’s likelihood of receiving an acquisition offer. The authors find that being a target is more likely for larger banks, banks with a lower return on assets, and banks with higher capital levels. In another country-level study, Zanakakis and Zopounidis (1997) investigate the financial characteristics of target Greek firms that were acquired between 1983 and 1990. The authors conclude that non-financial factors have a greater impact on acquisitions.

2.4. Studies That Focus on Financial Distress

There are also some studies in the literature in which performance evaluations for companies participating in M&A transactions are handled within a framework of financial distress. Pastena and Ruland (1986) identify companies that experienced financial distress among those participating in M&A transactions through a model developed by Altman (1968). Using data from 1970 to 1983, the authors found that company size, financial leverage, and ownership, including the M&A transaction, were determinants of whether the company would go bankrupt. In another study that considers the effect of financial distress, Theodossiou et al. (1996) examine the economic factors that influence the choice to buy financially distressed companies using the sequential response logit model. The authors compare the financial ratios of companies that had financial difficulties and entered into M&A transactions with companies that had financial difficulties and did not enter into M&A transactions. The authors conclude that financial leverage weakens the likelihood that insider control will be the target in an M&A transaction. Koetter et al. (2007) categorize nearly one thousand M&A transactions that they compiled from the banking sector in terms of whether the parties that entered into the transaction were in financial distress by examining the companies using financial ratios frequently used to evaluate banks. According to the empirical findings of the authors, if a bank is relatively large and subject to regulatory intervention, it enters an M&A transaction on the buying side.

2.5. Other Studies

In addition to these research areas, in a cross-border acquisition study, Fees and Thi Minh Nguyen (2022) examine the financial conditions of German firms acquired by Chinese firms before and after M&As by comparing the firms’ financial ratios during the relevant time periods. The authors find that the performances of the German companies varied according to the industries in which they operated, but they were not devalued in general despite being perceived as devalued by the German public. Kalsie and Singh (2022)

demonstrate that cash payments in mergers and acquisitions (M&As) positively impact operational and financial synergies, particularly in the context of Indian domestic M&A transactions, utilizing a unique composite synergy variable through principal component analysis (PCA) to accurately evaluate the synergistic benefits. Jiang and Noma (2024) explore the impact of geographic distance on the divestment decisions of Japanese multinationals, revealing that such distance plays a complex role, influenced by firm- and deal-level characteristics. Their study, which analyzes 868 acquisitions across 45 countries between 2005 and 2015, suggests that geographic distance's effect is moderated by factors like the firm size, age, control mode, and debt levels, challenging simplistic interpretations of its influence on foreign divestment. Metwalli and Demello (2020) provide a comprehensive update on merger and acquisition (M&A) trends in the Middle East from 2009 to 2018, highlighting significant growth in M&A activities, particularly in Israel, Saudi Arabia, UAE, Kuwait, and Egypt, driven by globalization, deregulation, and economic reforms. This study illustrates the region's evolving landscape, showing a shift toward mergers and diverse sectoral engagements, signaling its increasing attractiveness for foreign direct investment and potential for future M&A opportunities.

A survey by Haleblan et al. (2009) can be accessed for additional information related to the review of M&A in the literature. The authors classify the published studies according to their disciplines and research questions. Using 310 articles, the authors also identify trends in approaches to the subject. In Table 1, a general overview of notable studies on mergers and acquisitions can be found.

Table 1. Notable Studies on Mergers and Acquisitions.

Research Subject	Authors
Estimating potential target companies	Akhigbe et al. (2004); Ambrose and Megginson (1992); Palepu (1986)
Assessing stock performance using the event study method	Arslan and Simsir (2014); Asimakopoulos and Athanasoglou (2013); Eckbo et al. (1990); Halpern (1983); Prabhala (1997)
Examining the relationship between M&A success and particular factors by analyzing cross-border M&A transactions	Hitt and Pitano (2003); Kusewitt (1985); Savović (2016); Altunbas and Marques-Ibanez (2004); Fees and Thi Minh Nguyen (2022); Grigorieva and Petrunina (2015)
Evaluating M&A performance using accounting information and financial ratios	W. H. Goldberg (1983); Haleblan et al. (2009); Ramaswamy (1997); Steiner (1975); Zanakis and Zopounidis (1997)
Measuring the performance of target companies	Akben-Selcuk (2008, 2015); Lipeikyte (2015); Tuch and O'Sullivan (2007)
Investigating the connection between financial distress and M&A transactions	Bugeja (2015); Koetter et al. (2007); Pastena and Ruland (1986); Theodossiou et al. (1996)
Handling M&A transactions from human resources perspective	Demirtas and Simsir (2016); Kiessling and Harvey (2006); Marks and Mirvis (2011); Phillips and Zhdanov (2013)
Comparison of success based on the M&A process	Alsharairi et al. (2016); Masulis and Simsir (2018); Mueller and Sirower (2003)

2.6. Contributions of Our Article to the Existing Literature

As discussed in the previous subsections, target companies have not been extensively studied in the literature, especially in terms of the performance of financial ratios. Understanding the effect of acquisitions on target companies is critical not only for the benefit of target companies but also for acquirer companies. Acquirer companies can choose target companies according to their understanding of the post-acquisition performance of target companies by examining changes in the financial ratios. Cumming et al. (2023) provide

a review of M&As, and their research further supports our claim that target companies' financial ratios have not been examined enough in the literature. One important exception is Erel et al. (2015), who discuss how financial constraints decrease for target companies after an acquisition. Erel et al. (2015) mention that acquisitions decrease financial friction, especially for smaller target firms. The authors observe how investment increases and current asset requirements decrease for target firms after an acquisition. Although a pioneering study on the performance of target companies after an acquisition, it still does not investigate profitability, asset turnover, and market ratio relationships. In related research, Vayner and Rogova (2022) chose 70 acquisitions in BRICS countries to assess whether they are more successful for target companies experiencing losses rather generating profits prior to the acquisition. They also investigated the effect of the deal size on the success of the companies in the acquisition, finding insufficient evidence of a negative relationship. According to Okofo-Dartey (2021), in M&As in emerging countries, acquirers focus on the levels of financial leverage, market-to-book ratios, and cash and equivalents over total assets while choosing target companies. On the other hand, firm size and level of profitability do not affect the decisions of acquirers. Cheng et al. (2022) prove that an increase in the concentration of a customer base leads to a shift to non-cash payments. Although the behavior of target companies has been investigated to an extent, no thorough study exists that uses an extensive global timeframe dataset to examine the effects of cash and non-cash and high- and low-deal-value acquisitions on a broad range of financial ratios of target companies, which would shed light on the decisions of acquirer companies in making acquisitions.

This article aims to fill this gap by analyzing a global dataset spanning from 2010 to 2019, providing a broader perspective than most existing studies. By employing a wide set of financial ratios—spanning liquidity, profitability, leverage, and market valuation metrics—this research offers a robust evaluation of pre- and post-acquisition financial performances. Unlike prior work, we specifically investigate how cash vs. non-cash payments and deal values (low vs. high) impact target companies' financial outcomes. This dual focus provides actionable insights for acquirers, aiding in data-driven decisions in target selection based on expected improvements in financial performance. Our study not only builds upon foundational research but also addresses existing gaps by incorporating a broader and more diverse dataset, extending the temporal scope of analysis, and offering insights into previously underexplored dimensions in the literature. These contributions significantly advance the understanding of M&A dynamics, particularly from the perspective of target companies, and provide a valuable framework for acquirers in crafting acquisition strategies.

3. Data and Methodology

This section outlines the dataset and methods employed to evaluate the financial performance of target companies in M&A transactions. This study uses a global dataset of 3306 acquisitions from 2010 to 2019, extracted from Bloomberg Terminal, which includes completed deals involving public target companies with a disclosed value exceeding USD 100,000. The dataset spans 20 quarters pre-acquisition and 8 quarters post-acquisition, providing comprehensive financial statement data and transaction details such as payment type and deal value.

To analyze the financial impact of acquisitions, 16 financial ratios were selected across liquidity, profitability, leverage, asset management, and market valuation categories. Independent *t*-tests were applied to compare financial ratios across groups, classified by payment method (cash vs. non-cash) and deal size (high vs. low). Paired *t*-tests were conducted to assess quarter-to-quarter changes, capturing the temporal dynamics of financial performances during the pre- and post-acquisition periods. This methodological approach enables the exploration of how acquisitions affect target companies' financial ratios over time, shedding light on the specific periods in which these effects emerge or fade.

The research employs parametric tests, justified by the high number of observations, and refers to the central limit theorem instead of using non-parametric tests. This data-driven methodology offers a systematic way to assess the financial implications of M&A transactions while focusing on the evolving financial profiles of target companies post-acquisition.

3.1. Data

The financial statements and other related data of companies involved in M&A transactions were accessed through Bloomberg Terminal (“Bloomberg”) on 08 August 2022, applying the filters shown in Table 2. A total of 3690 M&A transactions from around the globe were found. These data allowed for an analysis of all global transactions within a decade.

Table 2. Filters used for the M&A transactions.

Filter Name	Constraint	# of Deals
Deal Status	Completed	790,388
Date Range	1 January 2010–31 December 2019	352,533
Ownership Size	%50.0001 or More	205,181
Sector and Industry	Financials and Utilities Excluded	164,044
Public or Private	Public	3968
Size of the Deal	More than USD 100,000	3690

Then, for the 3690 M&A transactions, data on the “Deal Type”, “Announcement Date”, “Completion Date”, “Target Company Name”, “Target Company Symbol on Exchange”, “Acquiring Company Name”, “Acquiring Company Symbol on Exchange”, “Total Disclosed Value of the Transaction (\$)”, “Payment Type”, and “Deal Status” were collected. In light of these explanatory data on the M&A transactions, 384 of the remaining deals in which the target company’s shares were delisted and investment funds introduced instead were eliminated. Consequently, 3306 M&A transactions were used.

Based on the “Announcement Date” data obtained for the M&A transactions, it was determined in the following step which fiscal quarters the relevant transactions occurred. After this determination, the financial quarters corresponding to the 20 financial quarters before the financial quarter in which the M&A transaction was announced and the financial quarters corresponding to the 8 financial quarters after the financial quarter in which the transaction was announced were calculated for the 3306 M&A transactions under the columns “First Quarter” and “Last Quarter”.

To analyze the performance of the target companies involved in the M&A transactions before and after the transaction, accounting data and stock market data were collected for each financial quarter (from Q – 20 to Q + 8) between the “First Quarter” and the “Last Quarter” of these companies.

In this research, as we aimed to examine the difference between cash and non-cash, as well as high-deal-value and low-deal-value, acquisitions for target companies in terms of financial ratios, we applied independent *t*-tests for the two groups for each quarter examined. The results are provided as *t*-values and significance levels. In addition, we wanted to examine the quarter-to-quarter change in the financial ratios by applying the paired *t*-test for each group, the *t*-values and significance levels are reported. While conducting the quarter-to-quarter tests, our aim was to understand the time periods in which the effect of the acquisition on the financial ratios appeared and disappeared for the target companies in the post-acquisition era. As an acquirer company’s involvement spans a period of time within the target company, examining this effect and determining when the target company’s financial ratios start to change is another topic that we aimed to examine.

Because we had a high number of observations in our research and referred to the central limit theorem, we chose to apply parametric *t*-tests to see the effect between the following two groups: cash–non-cash and high–low deal value. Our aim was to select the most commonly used ratios from the groups of liquidity ratios, asset management ratios, debt ratios, profitability ratios, and markets ratios; thus, we selected 16 different ratios to evaluate

the performance of the target companies. We chose all available acquisitions from 2010 to 2019 on a global scale that had financial statements for the 20 quarters prior and 8 quarters after the acquisition. It should be noted that it is a common practice for acquirer companies to delist target companies, making the financial statements of these private companies unavailable for the post-acquisition period. For this reason, we had a dataset of 3306 acquisitions. The effects of deal values and payment methods of acquisitions on the performance of target companies, in terms of financial ratios, have not been studied for such an extensive time period using global data. For this reason, we chose to examine these two variables.

We collected various financial ratios over 29 quarters for each acquisition. This approach allowed us to compare the financial ratios of the target companies before and after the acquisition. We used the following selected financial ratios: the current ratio, quick ratio, and cash ratio to indicate a firm's liquidity; the long-term debt to equity for the capital structure; the NOPAT-to-Sales, ROA, ROE, and profit margin for profitability; the interest coverage, asset turnover, and net fixed asset turnover for asset management; the Altman Z-score for financial stability; and the market cap, P/B, and P/E ratios as the market ratios.

At this stage, 16 distinct 3306×29 matrices, for the 16 financial ratios of the 3306 target companies in the 29 distinct financial quarters for the 3306 M&A deals, were created. However, because of a variety of factors, it was determined that each target company lacked the relevant quarterly financial ratio value. Following this determination, missing values were removed from the matrices, outliers were eliminated, and the sample was narrowed to the extent that there were sufficient data for 16 financial ratios.

To conduct a preliminary analysis of the dataset used in this study, we computed descriptive statistics on the deal values for all deals, as well as for the high-value, low-value, cash-based, and non-cash-based deals separately. A summary of the statistics is presented in Table 3.

Table 3. Descriptive Statistics for the Deal Values (all numbers are in thousands dollars).

Metric	Deal Value	High Deal Value	Low Deal Value	Cash Based	Non-Cash Based
Mean	1852.31	3640.69	63.93	1299.03	2553.98
Standard Error	119.59	230.99	1.45	100.65	237.15
Median	212.14	1077.79	43.49	256.09	156.21
Standard Deviation	6876.42	9391.22	58.94	4292.62	9092.59
Kurtosis	108.1	55.67	−0.46	378.32	53.84
Skewness	9.24	6.69	0.84	15.61	6.78
Maximum	122,966.08	122,966.08	211.91	122,965.95	109,885.70
Minimum	0.11	212.36	0.11	0.13	0.11
Sum	6,123,735.23	6,018,066.75	105,668.48	2,362,939.35	3,754,345.18
Count	3306	1653	1653	1819	1470

The descriptive statistics in Table 3 provide an overview of the deal values categorized into high-value and low-value deals and cash-based and non-cash-based transactions, as well as all deals. The mean deal value across all observations was USD 1852.31, with significant variability as evidenced by the large standard deviation of USD 6876.42. This variability aligns with the skewness and kurtosis values, indicating a dataset with pronounced asymmetries and a heavy tail. The mean deal value for the high-value transactions is larger than for the low-value deals, highlighting an important contrast between these categories. Interestingly, cash-based transactions have a lower mean deal value than non-cash-based transactions, reflecting differences in the transaction structures and, potentially, the nature of the assets involved in these deals. The large standard deviation and range of deal values across all categories underscore the considerable variability in the dataset.

This variability is further reflected in the skewness and kurtosis metrics, which suggest a right-skewed distribution with some extreme outliers, particularly for the high-value deals.

3.2. Methodology

To investigate the financial impact of the M&A transactions, two main statistical tests were employed. Independent *t*-tests were used to compare the means of the financial ratios across the groups categorized by payment method (cash vs. non-cash) and deal value (high vs. low). These tests evaluated whether there were statistically significant differences in the financial ratios between the groups. The independent *t*-test with unequal variances, also known as Welch's *t*-test, was used to compare the means of the two independent groups when the variances of the groups were not assumed to be equal. The *t*-statistic for Welch's *t*-test was calculated as follows:

$$T = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where

- $\bar{X}_1$ and $\bar{X}_2$ are the sample means for groups 1 and 2;
- s_1^2 and s_2^2 are the sample variances for groups 1 and 2;
- n_1 and n_2 are the sample sizes for groups 1 and 2;

And the degrees of freedom (d_f) for the *t*-distribution were calculated using the following formula:

$$d_f = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}$$

Under the null hypothesis ($H_0 : \mu_1 = \mu_2$), the *t*-statistic follows a *t*-distribution with the calculated degrees of freedom. This statistic is used to determine the *p*-value, which indicates whether the observed difference between the group means is statistically significant.

Additionally, paired *t*-tests were conducted to assess the quarter-to-quarter changes in the financial ratios within the same group. This test identifies the temporal effects of acquisitions on target companies. The *t*-statistic for the paired *t*-test was calculated as follows:

$$T = \frac{\bar{d}}{SE(\bar{d})}$$

where

- $\bar{d}$ denotes the mean difference between the paired observations, and it is calculated as follows:

$$\bar{d} = \frac{1}{n} \sum_{i=1}^n y_i - x_i$$

- $SE(\bar{d})$ is the standard error of the mean difference, which is given as follows:

$$SE(\bar{d}) = \frac{s_d}{\sqrt{n}}$$

- s_d indicates the standard deviation of the differences, calculated as follows:

$$s_d = \sqrt{\frac{\sum_{i=1}^n (d_i - \bar{d})^2}{n-1}}$$

- n is the number of paired observations.

4. Findings

In this research, we analyzed the performance of target companies before and after the acquisition by examining the financial ratios of the companies according to the acquisition medium, such as cash or non-cash, and the deal value, such as a low deal value and a high deal value. Firstly, we analyzed the effects of a cash or non-cash acquisition on the target companies. Although we analyzed the target companies, we mainly provide information for acquirer companies. According to the financial performance of the cash- and non-cash-acquired target companies, we aim to suggest the transaction medium—cash or non-cash—to the acquirer companies. Secondly, we also checked the performance of the target companies by looking at the financial ratios in terms of whether it was a low-deal-value acquisition or a high-deal-value acquisition. In a similar manner, from an acquirer's point of view, we wanted to indicate whether low-deal-value or high-deal-value companies performed better than their counterparts. In the following sub-chapters, we first determine the general effect of the acquisitions on the target companies according to whether it was a cash or non-cash transaction, as well as which kind of deal value. Secondly, for a more detailed analysis, we also observed the quarter-to-quarter effect in terms of cash, non-cash, low-value, and high-value transactions.

4.1. Effect of Cash or Non-Cash Acquisitions on Target Companies

As we analyzed the effects of cash or non-cash acquisitions on the target companies, in Table 4, the mean values of the target companies' financial ratios are given. The first numbers are the cash acquisitions, and the second numbers are the non-cash acquisitions. There are some important differences in the financial ratios of the cash- and non-cash-acquired target companies. It can be seen that the market capitalization values of the non-cash-acquired companies are always higher than those of the cash-acquired companies. This difference also increases on a regular basis from the start of the analysis period to the end of the analysis period covering the acquisition. By also mentioning the effect of the P/E ratio, the superior effect of the cash acquisitions compared to the non-cash acquisitions in terms of market ratios is shown. On the other hand, most of the ratios, especially the profitability and asset management ratios, exhibit a decreasing trend after the acquisition for the non-cash-acquired companies while the ratios increase for the cash-acquired companies. Even with this first table, we see the equalizing effect of the acquisitions for the ratios of cash and non-cash-acquired target companies.

In Table 5 we can find the mean differences in the cash-acquired target companies' and non-cash-acquired target companies' financial ratios for each quarter of the analysis period. Additionally, according to the independent *t*-test results, we show the statistical significance levels of the financial ratios' differences as well. While analyzing this output, we can clearly see the effects of the transaction mediums of the acquisitions on the target companies. For instance, cash-acquired target companies' liquidity ratios, such as current, quick, and cash ratio, increase to a statistically significant degree approximately one year after the acquisition. The cash-acquired companies improved their liquidity position more easily. The asset turnover ratio improved for companies acquired through non-cash means compared to those acquired with cash, which was observed both before and after the acquisition period. Interestingly, this effect begins several quarters prior to the actual acquisition and persists for a while before dissipating. Similarly, the interest coverage ratios for the non-cash-acquired companies showed improvement over their cash-acquired counterparts during the same timeframes, and this improvement tended to last longer. Moreover, the P/B ratio exhibited a trend in favor of the cash acquisitions. As mentioned in the previous paragraph, the market capitalizations of the non-cash-acquired target companies were always significantly higher than those of the cash-acquired target companies.

Table 4. Mean Values of the Cash-based vs. Non-cash-based Mergers According to the Quarter.

Period	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NEAT	P/B	P/E	MCap (\$M)
−Q20	1.44–1.42	0.83–0.91	0.37–0.39	30.07–43.20	7.27–8.34	4.34–4.02	9.65–12.20	5.15–6.41	2.67–2.89	4.87–4.38	0.46–0.45	6.65–5.51	3.15–3.04	1.65–1.81	15.41–14.74	913–1378
−Q19	1.36–1.43	0.84–0.90	0.37–0.39	29.90–40.55	7.28–8.36	4.61–4.44	10.06–13.09	5.00–6.06	2.75–2.96	4.87–5.70	0.46–0.45	6.63–5.38	3.16–3.09	1.61–1.95	15.90–14.68	890–1413
−Q18	1.38–1.38	0.84–0.85	0.36–0.34	30.03–39.81	7.07–7.87	4.56–4.50	10.05–13.91	5.12–5.69	2.72–3.01	4.33–5.20	0.46–0.44	6.53–5.00	3.10–3.05	1.63–2.05	14.68–14.22	886–1476
−Q17	1.41–1.36	0.82–0.78	0.34–0.30	31.64–41.65	7.10–7.25	4.48–4.42	9.87–13.69	5.32–6.10	2.72–2.88	5.74–3.45	0.46–0.44	6.41–5.54	3.11–3.05	1.65–2.08	14.25–14.14	886–1605
−Q16	1.38–1.33	0.79–0.81	0.31–0.31	31.99–42.54	7.13–7.25	4.22–4.50	9.20–14.37	5.67–6.87	2.73–2.80	5.52–4.22	0.45–0.43	6.55–5.30	3.13–3.06	1.56–1.96	14.68–14.09	896–1574
−Q15	1.41–1.37	0.83–0.85	0.33–0.34	33.44–42.89	7.05–7.24	4.09–4.48	9.15–13.44	5.16–5.91	2.78–2.80	5.04–3.94	0.45–0.43	6.48–5.49	3.17–3.09	1.52–1.87	14.67–14.00	934–1332
−Q14	1.40–1.39	0.82–0.86	0.34–0.36	32.03–41.73	6.91–6.85	3.95–4.40	9.00–12.72	5.49–5.54	2.77–2.87	4.74–4.09	0.45–0.45	6.46–5.60	3.23–3.07	1.49–1.85	14.54–13.81	992–1570
−Q13	1.38–1.39	0.79–0.87	0.34–0.35	33.79–41.92	6.78–7.49	3.89–4.70	8.76–12.70	4.63–6.41	2.68–2.92	4.58–4.05	0.44–0.42	6.38–5.80	3.15–3.03	1.41–1.96	14.34–14.53	935–1654
−Q12	1.39–1.40	0.82–0.84	0.34–0.35	34.50–40.66	6.67–7.17	4.10–4.36	9.16–11.07	4.30–6.06	2.69–2.94	4.11–4.14	0.44–0.41	6.25–5.75	3.13–3.00	1.43–1.82	15.61–14.66	993–1699
−Q11	1.42–1.39	0.82–0.86	0.35–0.36	34.71–38.86	6.53–7.01	4.03–4.92	9.30–11.63	5.77–5.81	2.65–2.91	4.82–5.15	0.43–0.42	6.22–5.72	3.15–2.88	1.44–1.84	15.13–14.43	1029–1681
−Q10	1.38–1.34	0.81–0.86	0.37–0.33	35.52–36.69	6.38–7.22	4.00–4.58	8.91–8.76	4.17–4.74	2.56–3.02	3.69–4.15	0.42–0.42	6.27–5.72	3.15–2.87	1.40–1.97	15.14–15.18	963–1774
−Q9	1.40–1.41	0.82–0.88	0.37–0.37	35.48–38.84	6.13–7.44	4.14–4.58	8.83–8.79	5.55–6.27	2.51–3.00	4.53–3.63	0.42–0.40	6.20–5.85	3.10–2.93	1.41–1.98	14.71–14.93	956–1862
−Q8	1.42–1.41	0.82–0.88	0.35–0.37	33.59–39.31	6.40–7.76	3.91–4.84	8.26–8.82	5.08–5.65	2.52–3.04	4.59–3.81	0.42–0.38	6.08–5.77	3.14–2.89	1.42–2.01	14.63–15.39	992–1934
−Q7	1.36–1.35	0.79–0.82	0.35–0.33	32.41–39.90	6.49–7.82	4.08–4.53	8.63–9.04	5.75–5.47	2.47–3.06	4.03–4.06	0.42–0.38	5.95–5.69	3.13–2.78	1.45–2.04	16.13–15.68	1042–2036
−Q6	1.36–1.34	0.80–0.82	0.37–0.34	33.88–37.16	6.60–8.09	4.30–4.90	9.18–12.49	4.24–6.27	2.53–3.11	4.48–4.27	0.44–0.39	6.15–5.78	3.14–2.69	1.43–2.10	16.09–16.39	1072–2103
−Q5	1.43–1.33	0.85–0.81	0.37–0.36	33.33–42.34	6.74–8.12	4.11–4.93	9.01–13.00	5.14–6.06	2.51–3.08	4.87–2.86	0.44–0.39	6.07–5.81	3.14–2.74	1.42–2.19	16.48–16.59	1151–2120
−Q4	1.42–1.30	0.84–0.77	0.35–0.32	34.66–43.23	6.52–8.24	4.36–5.50	9.73–13.97	5.45–7.44	2.64–3.00	4.60–4.01	0.47–0.38	6.19–5.71	3.15–2.80	1.48–2.10	17.28–15.08	1183–2184
−Q3	1.45–1.30	0.83–0.80	0.36–0.35	33.11–47.42	6.24–7.92	4.47–5.40	9.65–14.01	5.51–5.83	2.58–3.06	4.33–3.96	0.48–0.38	6.22–5.65	3.12–2.78	1.52–2.11	17.43–15.54	1193–2254
−Q2	1.42–1.30	0.83–0.80	0.37–0.35	38.07–47.04	6.43–7.32	4.38–5.02	9.66–11.85	5.67–5.53	2.56–3.11	4.98–2.61	0.49–0.37	6.30–5.68	3.12–2.74	1.48–2.03	17.45–16.50	1291–2257
−Q1	1.42–1.30	0.82–0.81	0.37–0.34	38.50–48.31	6.96–7.50	4.41–5.16	9.89–11.90	5.20–6.96	2.52–2.86	5.11–3.10	0.48–0.37	6.10–5.68	3.07–2.68	1.51–1.99	16.49–16.53	1362–2347
+Q0	1.43–1.32	0.86–0.78	0.38–0.32	36.99–46.81	6.79–7.43	4.72–4.58	9.97–11.86	5.68–6.87	2.64–2.96	4.48–3.39	0.48–0.36	6.37–5.68	3.08–2.78	1.57–2.06	17.02–18.07	1389–2599
+Q1	1.41–1.32	0.82–0.81	0.38–0.37	41.35–49.52	6.69–7.13	4.42–4.08	9.15–9.43	5.12–5.49	2.62–2.71	4.74–2.70	0.48–0.33	6.33–5.59	3.00–2.51	1.52–2.08	16.38–19.20	1395–3205
+Q2	1.40–1.28	0.80–0.79	0.36–0.36	42.73–48.27	6.41–7.84	4.31–4.35	8.74–9.65	5.40–4.27	2.58–2.57	4.67–3.01	0.45–0.34	6.18–5.88	2.98–2.56	1.52–2.03	18.52–19.03	1462–3769
+Q3	1.44–1.28	0.83–0.80	0.38–0.38	41.81–51.05	6.65–6.90	4.17–3.76	8.37–6.67	4.49–5.08	2.62–2.60	5.35–1.88	0.45–0.34	6.13–5.44	2.91–2.47	1.68–1.73	18.41–19.27	1558–4356
+Q4	1.44–1.24	0.84–0.70	0.39–0.29	43.39–48.18	6.81–5.37	3.97–3.37	8.10–5.20	5.32–7.28	2.59–2.52	4.44–1.67	0.46–0.34	6.21–5.47	2.91–2.52	1.73–1.73	18.78–18.92	1633–4443
+Q5	1.43–1.19	0.82–0.70	0.38–0.28	43.81–49.82	6.93–5.74	3.70–3.08	8.34–5.41	5.19–5.82	2.59–2.39	3.97–2.11	0.43–0.37	6.06–6.03	2.87–2.55	1.71–1.79	18.36–19.66	1602–4545
+Q6	1.44–1.18	0.82–0.69	0.36–0.26	43.82–51.53	7.59–4.87	3.85–2.68	9.00–4.95	4.65–4.08	2.64–2.42	3.98–2.04	0.43–0.33	5.89–6.80	2.82–2.63	1.67–1.79	18.03–20.50	1766–4286
+Q7	1.48–1.16	0.84–0.67	0.39–0.25	42.29–49.45	7.25–4.98	3.97–2.72	8.68–5.40	4.18–4.99	2.70–2.56	4.93–2.97	0.45–0.37	5.80–6.03	2.82–2.58	1.65–1.90	18.49–21.66	1912–4824
+Q8	1.46–1.21	0.83–0.69	0.35–0.27	41.21–50.67	7.01–6.32	4.02–3.04	7.61–6.09	5.11–5.68	2.74–2.46	4.07–3.13	0.47–0.36	5.93–5.68	2.89–2.54	1.66–1.87	17.94–22.55	1948–4505

This table presents the mean values of the cash-based vs. non-cash-based M&As before and after the transactions. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NEAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

Table 5. Independent Cash–Non-cash Mean Differences in Financial Ratios.

Period	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NFAT	P/B	P/E	MCap (\$M)
−Q20	−0.03	0.08	0.02	13.14 *	1.07	−0.32	2.55	1.26	0.22	−0.30	−0.01	−1.14	−0.11	0.16	−0.67	372.86
−Q19	0.07	0.07	0.02	10.65	1.09	−0.17	3.03	1.06	0.21	0.83	−0.01	−1.25	−0.06	0.34	−1.23	437.43
−Q18	−0.01	0.01	−0.02	9.78	0.80	−0.07	3.86 *	0.57	0.29	0.87	−0.02	−0.94	−0.04	0.42 *	−0.46	515.66
−Q17	−0.05	−0.04	−0.04	10.01	0.15	−0.06	3.82 *	0.78	0.11	−2.30	−0.02	−0.87	−0.06	0.44 *	−0.12	655.13 *
−Q16	−0.05	0.01	−0.00	10.55	0.12	0.28	5.17 **	1.21	0.07	−1.30	−0.02	−1.25 *	−0.06	0.41 *	−0.59	611.59 *
−Q15	−0.03	0.01	0.01	9.45	0.18	0.39	4.29 *	0.76	0.01	−1.10	−0.02	−1.00	−0.07	0.35	−0.67	570.29 *
−Q14	−0.01	0.04	0.02	9.70	−0.06	0.65	3.71	0.05	0.10	−0.65	−0.00	−0.86	−0.16	0.36	−0.73	571.28
−Q13	0.01	0.08	0.01	8.13	0.71	0.81	3.93	1.78	0.23	−0.53	−0.02	−0.57	−0.12	0.55 **	0.19	697.13 **
−Q12	0.01	0.03	0.01	6.16	0.70	0.26	1.90	1.76	0.25	0.03	−0.03	−0.50	−0.14	0.39	−0.95	659.76 *
−Q11	−0.03	0.04	0.01	4.15	0.48	0.89	2.34	0.03	0.28	0.34	−0.01	−0.47	−0.25	0.40	−0.69	587.81
−Q10	−0.04	0.05	−0.03	1.18	0.83	0.59	−0.15	0.57	0.45	0.46	−0.00	−0.55	−0.28	0.56 **	0.04	733.64 *
−Q9	0.01	0.06	−0.00	3.35	1.31	0.44	−0.04	0.72	0.49	−0.90	−0.02	−0.35	−0.17	0.56 **	0.21	812.86 *
−Q8	−0.01	0.06	0.02	5.72	1.36	0.94	0.56	1.57	0.53	−0.78	−0.03	−0.31	−0.25	0.59 **	0.76	832.88 *
−Q7	−0.01	0.03	−0.02	7.50	1.32	0.45	0.41	−0.28	0.59 *	0.04	−0.04	−0.27	−0.35	0.59 **	−0.45	914.68 *
−Q6	−0.02	0.02	−0.03	3.29	1.49	0.60	3.32	2.03	0.58 *	−0.21	−0.05	−0.38	−0.45	0.67 **	0.30	940.07 *
−Q5	−0.10	−0.04	−0.01	9.01	1.38	0.82	3.99 *	0.92	0.57 *	−2.01 *	−0.05	−0.26	−0.41	0.77 **	0.11	836.41
−Q4	−0.13	−0.07	−0.03	8.57	1.72	1.14	4.23 **	1.98	0.36	−0.59	−0.09 *	−0.48	−0.35	0.62 **	−2.20	890.49
−Q3	−0.15	−0.03	−0.01	14.30 *	1.68	0.92	4.37 **	1.32	0.48	−0.37	−0.10 *	−0.56	−0.35	0.59 **	−1.90	999.18 *
−Q2	−0.13	−0.03	−0.02	8.97	0.89	0.64	2.19	−0.14	0.55	−2.37 **	−0.12 **	−0.61	−0.38	0.55 *	−0.95	910.96
−Q1	−0.12	−0.01	−0.03	9.82	0.92	0.76	2.01	1.76	0.34	−2.01 **	−0.11 *	−0.42	−0.39	0.48 *	0.04	905.56
Q0	−0.11	−0.08	−0.07	9.82	0.64	−0.13	1.89	1.19	0.32	−1.09	−0.12 *	−0.69	−0.30	0.49 *	1.05	1164.98 *
+Q1	−0.10	−0.01	−0.00	8.16	0.44	−0.34	0.28	0.37	0.09	−2.04 *	−0.15 **	−0.74	−0.49	0.56 **	2.82	1763.42 **
+Q2	−0.12	−0.01	−0.00	5.54	1.42	0.05	0.90	−1.13	−0.02	−1.66	−0.11 **	−0.29	−0.42	0.51 *	0.51	2276.71 **
+Q3	−0.16	−0.04	0.00	9.24	0.25	−0.41	−1.70	0.59	−0.02	−3.47 ***	−0.11 **	−0.69	−0.44	0.05	0.87	2741.04 **
+Q4	−0.19 *	−0.14 **	−0.10 *	4.78	−1.44	−0.60	−2.90	−0.54	−0.08	−2.77 **	−0.12 **	−0.73	−0.39	−0.00	0.14	2708.32 **
+Q5	−0.24 **	−0.12 *	−0.10 **	6.01	−1.19	−0.62	−2.93 *	0.62	−0.19	−1.86 *	−0.06	−0.04	−0.32	0.08	1.30	2821.79 **
+Q6	−0.26 ***	−0.13 *	−0.10 **	7.71	−2.72 *	−1.17	−4.04 **	−0.57	−0.22	−1.94 *	−0.10 *	0.91	−0.19	0.12	2.47	2302.84 **
+Q7	−0.32 ***	−0.17 **	−0.15 ***	7.15	−2.27	−1.25 *	−3.28 *	0.81	−0.14	−1.97 **	−0.08	0.23	−0.24	0.25	3.18	2658.37 **
+Q8	−0.26 ***	−0.14 **	−0.08	9.46	−0.70	−0.98	−1.52	0.56	−0.26	−0.95	−0.11	−0.25	−0.35	0.21	4.61	2349.28 *

This table shows the mean differences in the financial ratios between the cash-based and non-cash-based mergers for each quarter. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NFAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

4.2. Quarter-to-Quarter Effect of Cash and Non-Cash Acquisitions on Target Companies

In addition to the general effect of the cash and non-cash acquisitions on the target companies, we also investigated their quarter-to-quarter effect. For this reason, we conducted paired sample *t*-tests for the successive quarters of both the cash-acquired and non-cash-acquired target companies. The results can be seen in Tables 6 and 7 for the cash and non-cash acquisitions, respectively. The numbers represent the differences from the previous quarter to the following quarter, and the levels of statistical significance of the quarter-to-quarter differences are also indicated by asterisks. We generally checked around the acquisition announcement date to see the specific quarter-to-quarter effects.

While looking at the cash acquisitions on a quarterly basis (Table 6), we mainly observed improvements in Altman Z-scores and inventory turnover ratios during the acquisition quarter. Also, NOPAT/Sales were observed to decrease significantly right after the acquisitions. The most prominent outcome in this quarter-to-quarter comparison for the cash-acquired target companies was that the market cap increased in a statistically significant manner after the acquisition, which is an important indicator of success for cash acquisitions. As we did not clearly observe long-lasting effects of cash acquisitions on market ratios in our general comparison of the performance of cash and non-cash target companies, we can conclude that cash acquisitions also increase shareholder value in a statistically significant manner in addition to having a better effect on other financial ratios, such as liquidity, asset management, and profitability.

The same increase in the market capitalization's effect is also valid for the non-cash acquisitions on a quarterly basis (Table 7). For non-cash-acquired target companies, we observed a clear negative trend in profitability, decreasing on a quarter-to-quarter basis during and immediately after the acquisition. We also noticed a negative impact of non-cash acquisitions on the Altman Z-score, net fixed asset turnover ratio, and asset turnover ratio starting in the first quarter right after the acquisition.

4.3. Effect of High-Deal-Value or Low-Deal-Value Acquisitions on Target Companies

The second approach that this paper took to the acquisitions was the effect of the deal value on the target companies' financial ratios. In this regard, all transactions were split into high-deal-value and low-deal-value acquisitions, and the mean values of the financial ratios for the high-deal-value and low-deal-value acquisitions are given in Table 8. The first numbers are the high-deal-value acquisitions' and the second numbers are the low-deal-value acquisitions' mean financial ratios. The increase in the current and quick ratios for the low-deal-value companies and the relative decrease in the profitability ratios for the high-deal-value companies after the acquisitions are interesting outcomes, as provided in Table 8.

Table 6. Paired-Sample *t*-Test Results for the Cash (Mean) Financial Ratios from −Q20 to +Q8.

Comparison	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NFAT	P/B	P/E	MCap (\$M)
−Q20−Q19	−0.08 **	0.01	0.01	−0.17	0.01	0.27	0.41	−0.15	0.07	−0.00	0.00	−0.02	0.01	−0.04	0.49	−29.86
−Q19−Q18	0.02	0.00	−0.01	0.13	−0.21	−0.05	−0.02	0.12	−0.02	−0.54	0.01	−0.09	−0.06	0.02	−1.22	−15.34
−Q18−Q17	0.02	−0.02	−0.02	1.61	0.03	−0.09	−0.17	0.21	0.05	1.42 **	−0.01	−0.13 *	0.02	0.01	−0.43	−10.23
−Q17−Q16	−0.02	−0.03	−0.04 **	0.36	0.03	−0.25 *	−0.67	0.34	−0.05	−0.22	−0.01	0.14	0.01	−0.09	0.43	12.71
−Q16−Q15	0.02	0.04 *	0.03	1.45	−0.08	−0.13	−0.05	−0.51	0.06	−0.48	0.00	−0.07	0.04	−0.04	−0.02	−1.05
−Q15−Q14	−0.00	−0.01	0.00	−1.41	−0.14	−0.15	−0.14	0.33	−0.01	−0.30	0.00	−0.02	0.06	−0.03	−0.12	36.70
−Q14−Q13	−0.02	−0.03	0.00	1.76	−0.13	−0.05	−0.24	−0.85	−0.09	−0.16	−0.01	−0.08	−0.08	−0.08	−0.20	−41.27
−Q13−Q12	0.01	0.03	0.00	0.71	−0.31	0.20	0.40	−0.33	0.01	−0.47	−0.00	−0.13	−0.02	0.02	1.26 ***	81.84 **
−Q12−Q11	0.03	0.00	0.00	0.21	0.06	−0.07	0.14	1.47 *	−0.06	0.70	−0.01	−0.03	−0.01	0.01	−0.48	53.67
−Q11−Q10	−0.04	−0.02	0.02	0.81	−0.15	−0.03	−0.39	−1.61 *	−0.07	−1.13	−0.01	0.05	0.03	−0.03	0.02	−51.95
−Q10−Q9	0.02	0.01	0.01	−0.03	−0.25 **	0.14	−0.08	1.38	−0.05	0.84	−0.00	−0.07	−0.05	0.01	−0.43	8.66
−Q9−Q8	0.02	−0.00	−0.02	−1.89	0.26	−0.23	−0.57	−0.47	0.00	0.06	−0.00	−0.12	0.04	0.01	−0.09	51.19 *
−Q8−Q7	−0.06	−0.03	−0.00	−1.19	0.10	0.18	0.37	0.67	−0.05	−0.56	0.00	−0.13	−0.01	0.04	1.51 ***	20.50
−Q7−Q6	0.00	0.01	0.02	1.47	0.10	0.22	0.55	−1.51 *	0.06	0.46	0.02	0.20 **	0.00	−0.03	−0.05	42.15
−Q6−Q5	0.07	0.06 *	−0.00	−0.55	0.14	−0.18	−0.17	0.91	−0.02	0.38	0.00	−0.08	0.00	−0.01	0.40	120.32 **
−Q5−Q4	−0.00	−0.01	−0.02	1.33	−0.22	0.25	0.72	0.31	0.13 **	−0.27	0.03	0.12	0.01	0.07	0.80	9.47
−Q4−Q3	0.02	−0.01	0.01	−1.54 *	−0.28	0.11	−0.09	0.06	−0.06	−0.27	0.01	0.03	−0.03	0.04	0.15	−38.63
−Q3−Q2	−0.02	0.00	0.01	4.96 *	0.19	−0.09	0.02	0.16	−0.02	0.65	0.01	0.08	−0.00	−0.04	0.02	91.27 *
−Q2−Q1	−0.01	−0.01	0.00	0.43	0.15	0.02	0.22	−0.46	−0.04	0.13	−0.01	−0.19 *	−0.05	0.04	−0.96	95.82
−Q1−Q0	0.01	0.04	0.01	−1.51	0.21	0.31	0.08	0.47	0.11 **	−0.63	−0.00	0.27 **	0.00	0.06	0.53	−7.38
Q0+Q1	−0.01	−0.04	−0.01	4.36	−0.10	−0.29	−0.82	−0.55	−0.02	0.25	0.00	−0.04	−0.07	−0.05	−0.64	7.10
+Q1+Q2	−0.02	−0.02	−0.01	1.37	−0.28 *	−0.12	−0.40	0.28	−0.03	−0.07	−0.03	−0.15	−0.02	0.00	2.15 **	51.38
+Q2+Q3	0.05	0.03	0.01	−0.91	0.24	−0.14	−0.37	−0.92	0.03	0.69	0.00	−0.05	−0.07 *	0.15	−0.12	122.68 *
+Q3+Q4	−0.01	0.01	0.02	1.58	0.16	−0.20	−0.27	0.84	−0.02	−0.91	0.01	0.08	0.00	0.06	0.37	118.95 *
+Q4+Q5	−0.00	−0.02	−0.01	0.42	0.12	−0.27	0.24	−0.13	−0.01	−0.47	−0.03	−0.15	−0.04	−0.02	−0.42	−10.63
+Q5+Q6	0.01	−0.00	−0.02	0.00	0.66 **	0.15	0.65	−0.54	0.05	0.01	0.00	−0.17	−0.04	−0.05	−0.33	259.46 **
+Q6+Q7	0.04	0.02	0.03 *	−1.52	−0.34 *	0.11	−0.32	−0.47	0.07	0.96 *	0.02 **	−0.10	−0.01	−0.02	0.46	182.16 **
+Q7+Q8	−0.01	−0.01	−0.04 *	−1.08	−0.24	0.05	−1.07	0.93	0.03	−0.86	0.02	0.13	0.07	0.01	−0.55	−9.48

This table presents the changes in the means of the financial ratios for the cash-based mergers across different quarters. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NFAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

Table 7. Paired-Sample *t*-Test Results for Non-Cash Financial Ratios from −Q20 to +Q8.

Comparison	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NEAT	P/B	P/E	MCap (\$M)
−Q20−Q19	0.01	−0.01	0.01	−2.66	0.02	0.42	0.89	−0.36	0.07	1.13 *	0.00	−0.14	0.05	0.14 *	−0.06	34.71
−Q19−Q18	−0.05	−0.06	−0.05	−0.74	−0.49	0.06	0.82	−0.37	0.05	−0.51	−0.01	0.22 *	−0.04	0.10	−0.46	62.89
−Q18−Q17	−0.02	−0.07 ***	−0.05 ***	1.84	−0.62	−0.08	−0.22	0.42	−0.12	−1.75	0.00	−0.06	−0.00	0.04	−0.08	129.24 **
−Q17−Q16	−0.02	0.02	0.01	0.89	0.01	0.08	0.67	0.77	−0.09	0.77	−0.01 *	−0.24 *	0.01	−0.12 *	−0.05	−30.83
−Q16−Q15	0.04	0.04 *	0.03	0.35	−0.02	−0.01	−0.93	−0.96 *	−0.00	−0.28	0.00	0.18	0.03	−0.09	−0.09	−42.36
−Q15−Q14	0.01	0.01	0.02	−1.17	−0.39 **	0.11	−0.72	−0.37	0.07	0.15	0.02	0.12	−0.02	−0.02	−0.19	37.70
−Q14−Q13	0.00	0.01	−0.01	0.19	0.64	0.10	−0.02	0.87	0.05	−0.04	−0.03 ***	0.20	−0.04	0.11	0.72	84.58 *
−Q13−Q12	0.01	−0.02	−0.00	−1.26	−0.33	−0.34	−1.63 *	−0.35	0.03	0.09	−0.01	−0.06	−0.04	−0.14	0.12	44.47
−Q12−Q11	−0.01	0.02	0.01	−1.80	−0.16	0.56 **	0.57	−0.25	−0.03	1.01	0.01	0.01	−0.12	0.01	−0.22	−18.28
−Q11−Q10	−0.05	−0.00	−0.02	−2.17	0.21	−0.32	−2.87 *	−1.07	0.11	−1.01	−0.00	−0.04	−0.01	0.13 **	0.75 **	93.88
−Q10−Q9	0.07 **	0.03	0.04 **	2.14	0.23 *	−0.02	0.03	1.54	−0.02	−0.51	−0.02	0.13	0.06	0.01	−0.25	87.88
−Q9−Q8	−0.01	−0.01	0.00	0.48	0.32	0.26	0.03	0.37	0.04	0.18	−0.02 *	−0.08	−0.04	0.04	0.46	71.21
−Q8−Q7	−0.06	−0.06 **	−0.04 *	0.59	0.06	−0.31	0.23	−1.18	0.02	0.25	−0.00	−0.08	−0.11 **	0.03	0.30	102.30
−Q7−Q6	−0.00	−0.00	0.01	−2.74	0.27	0.37 *	3.45 *	0.80	0.05	0.21	0.00	0.09	−0.09	0.05	0.71	67.54
−Q6−Q5	−0.01	−0.01	0.02	5.17	0.04	0.03	0.50	−0.21	−0.04	−1.42	0.00	0.04	0.05	0.10	0.20	16.65
−Q5−Q4	−0.03	−0.04	−0.05 *	0.89	0.11	0.56	0.97	1.38 *	−0.08	1.15	−0.01	−0.11	0.06 *	−0.09 **	−1.51 *	63.56
−Q4−Q3	0.00	0.03	0.03	4.19	−0.31	−0.10	0.05	−0.61	0.06	−0.04	0.00	−0.05	−0.02	0.02	0.46	70.06
−Q3−Q2	−0.00	0.00	−0.00	−0.37	−0.60	−0.37	−2.16	−1.30 **	0.05	−1.35 **	−0.01	0.03	−0.04	−0.09	0.96	3.04
−Q2−Q1	0.00	0.01	−0.00	1.27	0.19	0.14	0.05	1.44	−0.25	0.49	−0.00	−0.00	−0.06	−0.04	0.03	90.43
−Q1−Q0	0.02	−0.03	−0.02	−1.50	−0.07	−0.58	−0.04	−0.09	0.10	0.29	−0.01	−0.00	0.09	0.07	1.54	252.05 **
Q0+Q1	−0.00	0.03	0.05	2.71	−0.31	−0.50 **	−2.43 **	−1.38	−0.25 **	−0.69	−0.03 ***	−0.09	−0.26 *	0.02	1.13	605.54 *
+Q1+Q2	−0.04	−0.02	−0.01	−1.24	0.71	0.27	0.22	−1.22	−0.14	0.31	0.01	0.29	0.05	−0.05	−0.16	564.67 *
+Q2+Q3	0.00	0.01	0.02	2.78	−0.93 **	−0.60 **	−2.97 **	0.80	0.03	−1.13	0.00	−0.43	−0.09	−0.30	0.24	587.01 *
+Q3+Q4	−0.04	−0.10 *	−0.09 *	−2.88	−1.53 **	−0.39	−1.47 *	−0.30	−0.08	−0.21	0.00	0.03	0.06	0.00	−0.35	86.23
+Q4+Q5	−0.05	0.00	−0.01	1.65	0.37	−0.29	0.21	1.04	−0.13	0.44	0.02	0.55	0.02	0.06	0.74	102.84
+Q5+Q6	−0.01	−0.01	−0.02	1.71	−0.87	−0.40	−0.46	−1.74 *	0.03	−0.07	−0.03	0.77 **	0.08	0.00	0.84	−259.49
+Q6+Q7	−0.02	−0.02	−0.02	−2.08	0.11	0.04	0.45	0.91	0.14	0.93 *	0.04	−0.78	−0.05	0.11	1.17	537.69 ***
+Q7+Q8	0.05	0.02	0.02	1.22	1.33 **	0.32 *	0.69	0.68	−0.08	0.16	−0.01	−0.34	−0.04	−0.03	0.89	−318.58

This table presents the changes in the means of the financial ratios for the non-cash-based mergers across different quarters. ***, **, and * indicate significance at the 0.001, 0.01, and 0.05 levels, respectively. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NEAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

Table 8. Mean Values of the High-value vs. Low-value Mergers, According to the Quarter.

Period	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NFAT	P/B	P/E	MCap (\$M)
-Q20	1.43-1.44	0.89-0.83	0.39-0.36	40.06-29.84	8.63-6.66	4.31-4.14	13.47-7.80	6.76-4.31	2.81-2.68	5.52-3.93	0.51-0.39	6.53-5.83	2.85-3.36	2.12-1.30	15.73-14.53	1661-556
-Q19	1.44-1.33	0.92-0.81	0.42-0.34	39.74-27.93	8.69-6.62	4.73-4.36	14.29-8.18	6.80-3.83	2.88-2.76	5.76-4.70	0.52-0.39	6.64-5.90	2.84-3.43	2.15-1.32	15.82-14.96	1642-551
-Q18	1.41-1.35	0.87-0.81	0.40-0.32	38.48-28.82	8.19-6.50	4.79-4.29	14.69-8.38	5.84-4.74	2.86-2.78	5.84-3.92	0.51-0.38	6.66-5.88	2.79-3.37	2.21-1.36	15.20-13.78	1634-571
-Q17	1.39-1.38	0.81-0.81	0.36-0.29	40.98-29.70	7.75-6.54	4.80-4.11	14.47-8.22	6.50-4.62	2.82-2.81	5.58-3.81	0.51-0.39	6.54-5.78	2.79-3.39	2.21-1.39	14.61-13.79	1670-592
-Q16	1.36-1.36	0.79-0.80	0.33-0.28	41.53-30.26	7.62-6.72	4.80-3.85	14.66-7.72	6.90-4.17	2.70-2.80	5.47-3.37	0.50-0.37	6.54-5.86	2.77-3.43	2.04-1.37	14.64-14.23	1662-601
-Q15	1.41-1.37	0.84-0.83	0.37-0.30	41.76-32.13	7.55-6.68	4.84-3.85	13.81-7.79	6.36-4.41	2.77-2.80	4.86-4.22	0.51-0.37	6.55-5.85	2.88-3.40	1.94-1.34	14.65-14.12	1606-632
-Q14	1.38-1.41	0.84-0.83	0.38-0.31	40.11-31.14	7.37-6.40	4.48-3.91	13.13-7.75	6.36-4.62	2.82-2.79	5.08-3.79	0.53-0.37	6.56-5.88	2.91-3.42	1.95-1.29	14.55-13.92	1725-588
-Q13	1.39-1.38	0.84-0.80	0.37-0.32	42.22-31.35	7.72-6.34	4.44-3.95	12.87-7.69	5.97-4.41	2.77-2.76	5.22-3.43	0.50-0.36	6.61-5.82	2.85-3.36	1.97-1.24	15.24-13.60	1663-636
-Q12	1.35-1.43	0.82-0.84	0.37-0.32	42.21-31.30	7.72-5.69	4.24-4.15	11.72-8.07	6.42-3.25	2.86-2.70	4.82-3.39	0.50-0.36	6.38-5.83	2.79-3.37	1.89-1.25	15.65-14.77	1772-670
-Q11	1.38-1.44	0.84-0.83	0.38-0.32	41.39-31.03	7.67-5.71	4.64-4.09	11.96-8.43	6.77-4.77	2.74-2.73	5.28-4.64	0.49-0.36	6.53-5.64	2.83-3.23	1.91-1.25	15.40-14.28	1872-638
-Q10	1.35-1.38	0.86-0.79	0.38-0.32	40.30-31.52	7.76-5.58	4.46-4.00	9.59-8.11	5.25-3.44	2.77-2.68	4.74-3.01	0.49-0.35	6.53-5.68	2.82-3.27	1.98-1.24	15.80-14.52	1886-600
-Q9	1.40-1.40	0.85-0.84	0.39-0.36	40.75-32.65	7.79-5.39	4.33-4.28	9.53-8.10	6.03-5.53	2.72-2.65	4.40-3.85	0.48-0.34	6.53-5.66	2.87-3.20	1.99-1.24	15.24-14.36	1942-605
-Q8	1.36-1.47	0.83-0.85	0.38-0.34	39.98-31.41	7.87-5.88	4.53-3.99	9.51-7.43	6.78-4.35	2.70-2.70	4.01-4.48	0.48-0.32	6.34-5.63	2.90-3.19	2.01-1.25	15.76-14.13	2004-656
-Q7	1.33-1.38	0.81-0.79	0.36-0.33	40.59-29.74	7.87-6.05	4.36-4.14	9.95-7.65	6.46-4.84	2.71-2.66	4.48-3.59	0.47-0.33	6.41-5.33	2.89-3.11	2.04-1.29	15.76-16.13	2040-707
-Q6	1.34-1.37	0.82-0.79	0.38-0.34	37.46-32.71	7.95-6.29	4.75-4.31	12.74-8.17	6.47-3.25	2.71-2.77	4.79-3.97	0.47-0.36	6.49-5.60	2.76-3.17	2.02-1.31	16.46-15.97	2129-716
-Q5	1.36-1.42	0.83-0.84	0.41-0.33	40.15-33.20	7.94-6.52	4.57-4.28	12.35-8.75	6.38-4.47	2.74-2.68	3.86-4.07	0.47-0.36	6.55-5.44	2.83-3.14	2.06-1.33	17.40-15.66	2356-672
-Q4	1.31-1.45	0.80-0.83	0.31-0.37	42.40-33.26	8.06-6.19	4.92-4.66	12.49-10.24	7.71-4.41	2.72-2.81	4.53-4.13	0.45-0.40	6.40-5.70	2.76-3.27	2.07-1.34	17.33-15.40	2341-736
-Q3	1.33-1.45	0.83-0.81	0.39-0.32	45.33-31.51	8.07-5.59	4.78-4.87	12.05-10.61	6.52-5.32	2.67-2.83	4.21-4.12	0.45-0.42	6.51-5.61	2.72-3.26	2.12-1.34	17.90-15.38	2313-747
-Q2	1.31-1.44	0.82-0.82	0.40-0.32	45.97-36.83	7.70-5.78	4.34-4.91	10.08-10.93	6.18-5.05	2.76-2.76	3.73-4.11	0.44-0.42	6.46-5.78	2.65-3.30	2.06-1.29	18.22-15.88	2429-765
-Q1	1.31-1.43	0.82-0.81	0.40-0.32	47.90-36.35	7.81-6.00	4.70-4.68	10.42-10.91	6.51-5.00	2.56-2.73	3.70-4.74	0.45-0.41	6.34-5.63	2.62-3.22	2.04-1.32	18.66-14.35	2570-813
+Q0	1.28-1.49	0.79-0.87	0.38-0.35	46.27-34.97	7.62-6.42	4.22-5.12	10.53-10.86	6.40-5.71	2.62-2.89	3.82-4.18	0.44-0.40	6.33-6.01	2.66-3.26	2.10-1.40	20.01-14.90	2665-846
+Q1	1.30-1.46	0.80-0.83	0.40-0.34	53.44-35.20	7.56-6.12	4.28-4.31	9.45-9.07	6.91-3.52	2.48-2.82	3.92-3.73	0.41-0.41	6.29-5.95	2.52-3.11	2.02-1.42	20.32-14.79	3324-917
+Q2	1.26-1.45	0.77-0.83	0.38-0.35	51.27-38.20	7.98-5.84	4.52-4.13	9.63-8.56	5.77-4.30	2.37-2.79	2.91-4.97	0.39-0.40	6.26-5.92	2.56-3.08	1.94-1.47	20.47-17.00	3738-1004
+Q3	1.27-1.50	0.79-0.85	0.38-0.38	53.46-36.93	7.48-5.99	2.80-4.10	6.28-8.60	5.55-3.77	2.37-2.85	2.57-5.06	0.40-0.40	6.05-5.83	2.48-3.00	1.76-1.64	20.51-17.03	3913-1050
+Q4	1.41-1.20	0.72-0.87	0.32-0.31	50.59-39.67	6.69-5.89	2.58-3.88	4.89-8.38	4.50-5.82	2.31-2.83	2.24-4.20	0.39-0.42	6.20-5.80	2.50-3.03	1.84-1.62	20.62-17.05	3920-1084
+Q5	1.45-1.23	0.84-0.72	0.38-0.31	38.54-53.79	6.29-6.72	2.55-4.02	5.7-8.12	4.18-5.64	2.95-2.7	5.7-4.34	0.43-0.37	6.28-6.62	3.7-2.99	1.81-2.21	16.58-24.39	1256-7388
+Q6	1.45-1.23	0.83-0.71	0.34-0.31	36.07-57.63	6.69-6.53	3.22-3.76	6.2-8.17	3.74-5.22	2.96-2.67	5.84-4.08	0.39-0.38	5.91-6.95	3.83-3.1	1.68-2.24	15.99-25.91	1256-7547
+Q7	1.49-1.22	0.84-0.72	0.37-0.31	36.37-53.81	6.33-6.55	3.27-4.16	7.39-8.58	4.02-4.88	2.87-2.88	4.63-4.04	0.45-0.38	6.12-6.55	3.96-3.1	1.64-2.32	16.82-29.85	1368-8395
+Q8	1.49-1.24	0.82-0.74	0.33-0.32	36.1-53.65	6.28-7.26	2.95-4.27	8.15-7.27	4.74-5.86	2.92-2.86	4.5-3.38	0.46-0.38	6.48-6.49	3.98-3.06	1.58-2.39	16.05-28.86	1314-8500

This table presents the mean values of the companies' ratios for 20 quarters prior to and 8 quarters after the acquisitions, sorted according to their deal values. The first numbers are the high-deal-value acquisition target companies, and the second numbers are the low-deal-value acquisition target companies. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NFAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

To compare the effect of the high-deal-value and low-deal-value acquisitions on the target companies, the differences in the high-deal-value and low-deal-value companies' financial ratios for each quarter are presented in Table 9. To determine the statistical significance of the differences in the financial ratios between the high-deal-value and low-deal-value companies, independent *t*-tests were performed. The level of statistical significance is indicated by asterisks for each quarter and ratio. According to the results, as a liquidity ratio, the current ratio of the high-deal-value target companies performed better than for the low-deal-value target companies in a statistically significant manner. Moreover, we can see that the long-term leverage (i.e., debt-to-equity) ratio exhibited a sharper decrease for the high-deal-value target companies compared to the low-deal value target companies. The gap between the high-deal-value companies and the low-deal-value companies was also small in terms of the profit margin but in favor of the low-deal-value target companies during the acquisition quarter, which might be due to insider trading. Another point of view is that the better performance of the target companies might trigger the acquirer companies. An interesting finding is that the P/B and P/E ratios shifted in favor of the low-deal-value target companies. This advantage is evident in the P/B ratio for all quarters before the announcement and for two quarters afterward. For the P/E ratio, the benefit is noticeable one quarter before, during, and one quarter after the acquisition. In general, the low-deal-value acquisitions led to better results for the target companies in terms of financial ratios.

4.4. Quarter-to-Quarter Effect of Low-Deal-Value and High-Deal-Value Acquisitions on Target Companies

After investigating the general effect of the low-deal-value and high-deal-value acquisitions' effect on the target companies, we also checked the quarter-to-quarter changes in the financial ratios of the low-deal-value and high-deal-value acquired target companies. In Table 10, we provide the quarter-to-quarter differences for all ratios of the low-deal-value target companies. The difference in the previous quarter's value and the following quarter's value is given for each ratio. Asterisks indicate the levels of statistical significance of the changes on a quarterly basis according to paired sample *t*-tests. The same procedure was applied for the high-deal-value companies, the results of which can be found in Table 11.

Looking at Table 10, especially around the acquisition announcement date, we can observe that there was a negative movement in the profitability ratios right after the acquisition announcements. This occurred in the first quarter for the profit margin, return on equity, and return on assets in a statistically significant way. Statistically significant effects occurred in the second and third quarters after the acquisition announcement for the remaining profitability ratios of NOPAT/Sales and return on equity, respectively. Another important outcome is the increase in the market cap, as well as the P/E ratio, only a couple of quarters after the acquisition for the low-deal-value target companies. Similar to the cash and non-cash acquisitions, for the low-deal-value and high-deal-value acquisitions it was not possible to compare the effect on the market cap. However, with the specific quarter-to-quarter comparisons, we could distinguish a positive effect of the low-deal-value acquisitions on the market cap, as well as partly on the market ratios of the target companies.

Looking at Table 10, we can observe the effect of a quarter-to-quarter increase in the market cap, in a very similar manner, around the acquisition announcement date. For all target companies, the acquisition had a positive effect on the shareholder value. Additionally, high-deal-value acquisition target companies performed negatively in terms of the asset turnover ratio, Altman Z-score, and interest coverage ratio right after the acquisition quarter. A few quarters later, significant decreases in the profitability ratios, such as the return on assets and return on equity, in addition to the liquidity ratios, such as the quick ratio and cash ratio, were also observed. Therefore, it is possible to assert that the high-deal-value acquisitions did not have a positive effect for most of the financial ratios on a quarter-to-quarter basis as well.

Table 9. Mean Differences between the High-Deal-Value and Low-Deal-Value Mergers, According to the Quarter.

Period	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NEAT	P/B	P/E	MCap (\$M)
-Q20	0.02	-0.05	-0.04	-10.22	-1.97*	-0.17	-5.67***	-2.45**	-0.13	-1.59	-0.13**	-1.00	0.51	-0.82***	-1.21	-1105.74***
-Q19	-0.11	-0.11	-0.08	-11.81*	-2.07*	-0.37	-6.11***	-2.96***	-0.11	-1.06	-0.13**	-0.74	0.58	-0.83***	-0.85	-1091.71***
-Q18	-0.07	-0.06	-0.08	-9.66	-1.69	-0.50	-6.31***	-1.11	-0.08	-1.56	-0.14**	-0.78	0.58	-0.85***	-1.41	-1062.53***
-Q17	-0.01	-0.00	-0.07	-11.28	-1.22	-0.69	-6.25***	-1.88	-0.00	-1.76	-0.12*	-0.76	0.61	-0.82***	-0.82	-1077.78***
-Q16	-0.00	0.01	-0.05	-11.27	-0.90	-0.95	-6.94***	-1.73	0.10	-1.10	-0.14**	-0.67	0.66	-0.67***	-0.41	-1060.56***
-Q15	-0.04	-0.01	-0.06	-9.63	-0.87	-0.79	-6.02***	-1.95*	0.03	-0.64	-0.15**	-0.70	0.51	-0.60***	-0.52	-973.92***
-Q14	0.02	-0.01	-0.07	-8.97	-0.97	-0.57	-5.38**	-1.74	-0.03	-1.29	-0.16***	-0.68	0.51	-0.66***	-0.63	-1137.09***
-Q13	-0.01	-0.04	-0.05	-10.87	-1.37	-0.49	-5.18**	-1.56	-0.01	-1.79*	-0.14**	-0.79	0.50	-0.73***	-1.64	-1027.22***
-Q12	0.08	0.02	-0.04	-10.91*	-2.02*	-0.10	-3.65*	-3.17**	-0.16	-1.43	-0.14**	-0.55	0.58	-0.64***	-0.89	-1102.79***
-Q11	0.06	-0.01	-0.07	-10.37*	-1.96*	-0.55	-3.53*	-2.01	-0.01	-0.63	-0.13**	-0.89	0.40	-0.66***	-1.12	-1233.72***
-Q10	0.03	-0.06	-0.06	-8.78	-2.18*	-0.46	-1.48	-1.79	-0.09	-1.73*	-0.14***	-0.85	0.44	-0.74***	-1.28	-1286.65***
-Q9	0.00	-0.01	-0.03	-8.11	-2.40**	-0.05	-1.43	-0.50	-0.07	-0.55	-0.14***	-0.86	0.33	-0.76***	-0.88	-1336.36***
-Q8	0.12	0.01	-0.04	-8.57	-1.99*	-0.53	-2.08	-2.43**	-0.00	0.46	-0.15***	-0.71	0.29	-0.76***	-1.63	-1347.88***
-Q7	0.04	-0.02	-0.03	-10.85*	-1.82*	-0.21	-2.27	-1.63	-0.05	-0.90	-0.15***	-1.08	0.22	-0.76***	0.37	-1333.40***
-Q6	0.02	-0.03	-0.03	-4.75	-1.66	-0.44	-4.57**	-3.22**	0.06	-0.81	-0.11**	-0.90	0.41	-0.72***	-0.49	-1413.57***
-Q5	0.06	0.01	-0.07	-6.95	-1.43	-0.29	-3.60*	-1.91	-0.06	0.21	-0.11**	-1.12	0.31	-0.74***	-1.75	-1683.98***
-Q4	0.14	0.03	-0.06	-9.14	-1.87*	-0.25	-2.25	-3.29**	0.09	-0.40	-0.05	-0.71	0.51	-0.73***	-1.93	-1604.71***
-Q3	0.11	-0.02	-0.08	-13.81*	-2.48**	0.09	-1.43	-1.20	0.16	-0.09	-0.03	-0.90	0.55	-0.78***	-2.52	-1565.64***
-Q2	0.12	-0.01	-0.07	-9.14	-1.92*	0.57	0.84	-1.12	-0.00	0.38	-0.02	-0.68	0.66	-0.77***	-2.34	-1664.35***
-Q1	0.12	-0.02	-0.08	-11.55	-1.81	-0.01	0.49	-1.51	0.18	1.05	-0.04	-0.71	0.60	-0.72***	-4.31**	-1757.01***
Q0	0.22**	0.08	-0.03	-11.30	-1.20	0.90	0.33	-0.69	0.27	0.36	-0.04	-0.32	0.60	-0.71***	-5.11*	-1818.13***
+Q1	0.16*	0.02	-0.06	-18.25**	-1.45	0.02	-0.38	-3.39***	0.35	-0.19	0.00	-0.34	0.60	-0.61**	-5.53**	-2122.63***
+Q2	0.18*	0.06	-0.03	-13.07	-2.14*	-0.40	-1.07	-1.47	0.43	2.06	-0.02	-0.34	0.51	-0.48*	-3.46	-2406.70***
+Q3	0.23**	0.07	0.00	-16.53**	-1.49	0.19	0.59	-1.78	0.48	2.49*	0.00	-0.22	0.52	-0.12	-3.48	-2734.02***
+Q4	0.27***	0.15**	0.07	-10.92	-0.79	0.06	0.30	-0.97	0.52*	1.95	0.03	-0.40	0.53	-0.22	-3.57	-2863.27***
+Q5	0.21**	0.12	0.07	-13.36	-0.32	0.36	1.43	-2.24**	0.42	0.34	0.05	-0.89	0.41	-0.27	-5.17*	-2835.40***
+Q6	0.20**	0.12	0.03	-19.65**	0.32	0.17	1.82	-1.17	0.51	0.97	0.00	-1.33	0.27	-0.37	-7.04**	-2995.51***
+Q7	0.25**	0.13*	0.05	-15.58*	-0.09	0.35	1.57	-0.36	0.41	1.18	0.06	-1.17	0.34	-0.28	-8.35**	-3374.66***
+Q8	0.24**	0.09	-0.00	-15.66*	-0.90	-0.14	0.67	-0.87	0.36	1.28	0.08	-1.01	0.34	-0.31	-9.06**	-3335.97***

This table presents the mean differences in the high-deal-value acquired target companies and the low-deal-value acquired target companies for the financial ratios in the 20 quarters prior to and 8 quarters after the acquisitions. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NFAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

Table 10. Paired-Sample Low-Deal-Value Mean Differences Across Various Financial Metrics.

Comparison	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NFAT	P/B	P/E	MCap (\$M)
−Q20−Q19	−0.11 ***	−0.03	−0.02	−1.91	−0.04	0.22	0.37	−0.48	0.08	0.78	0.00	0.07	0.06	0.02	0.44	−5.03
−Q19−Q18	0.02	0.01	−0.02	0.89	−0.12	−0.07	0.21	0.90	0.02	−0.78	−0.00	−0.02	−0.06	0.03	−1.18	20.83
−Q18−Q17	0.04	−0.01	−0.02 *	0.88	0.03	−0.17	−0.16	−0.12	0.03	−0.11	0.00	−0.10	0.02	0.04	0.01	20.62
−Q17−Q16	−0.02	−0.00	−0.01	0.57	0.18	−0.26	−0.50	0.56	−0.01	0.56	−0.02	0.08	0.04	−0.03	0.44	9.31
−Q16−Q15	0.01	0.03	0.02	1.87	−0.04	−0.01	0.07	−0.76 *	0.00	−0.16	−0.00	−0.01	−0.03	−0.02	−0.10	30.87 *
−Q15−Q14	0.03	−0.01	0.01	−0.99	−0.28	0.06	−0.05	0.21	−0.01	−0.43	0.00	0.03	0.03	−0.06 *	−0.20	−44.61
−Q14−Q13	−0.03	−0.03	0.01	0.21	−0.06	0.04	−0.06	−0.21	−0.03	−0.36	−0.01	−0.06	−0.07	−0.04	−0.32	48.39 **
−Q13−Q12	0.06 **	0.04	0.01	−0.06	−0.65	0.20	0.38	−1.15	−0.06	−0.03	0.00	0.01	0.01	0.01	1.17 **	33.74
−Q12−Q11	0.01	−0.01	−0.01	−0.27	0.02	−0.06	0.36	1.51	0.03	1.25	0.01	−0.19	−0.14	0.00	−0.49	−31.65
−Q11−Q10	−0.06	−0.04	0.01	0.49	−0.13	−0.09	−0.32	−1.32	−0.04	−1.63	−0.02	0.04	0.03	−0.02	0.24	−38.18
−Q10−Q9	0.02	0.04	0.03 **	1.13	−0.19 *	0.28 *	−0.01	2.09 *	−0.03	0.84	−0.01	−0.02	−0.06	−0.00	−0.15	5.66
−Q9−Q8	0.07	0.01	−0.02	−1.24	0.49	−0.29	−0.67	−1.18	0.05	0.63	−0.02	−0.03	−0.01	0.02	−0.23	50.95 *
−Q8−Q7	−0.10 *	−0.06 **	−0.01	−1.67	0.17	0.15	0.22	0.49	−0.05	−0.89	0.01	−0.30 **	−0.08	0.04	2.00 ***	50.31 *
−Q7−Q6	−0.01	0.00	0.02	2.97	0.24	0.16	0.52	−1.58	0.11 **	0.39	0.03 *	0.26 **	0.06	0.02	−0.17	9.07
−Q6−Q5	0.06	0.05	−0.01	0.49	0.22 *	−0.03	0.58	1.21	−0.09 **	0.10	0.01	−0.16	−0.03	0.02	−0.31	−43.49
−Q5−Q4	0.02	−0.02	−0.02	0.06	−0.32	0.39	1.49 **	−0.05	0.13	0.06	0.04 **	0.26 *	0.13 **	0.01	−0.26	64.03 **
−Q4−Q3	0.00	−0.02	0.01	−1.75 **	−0.60	0.20	0.37	0.91	0.02	−0.01	0.02	−0.09	−0.01	0.00	−0.02	10.89
−Q3−Q2	−0.01	0.01	0.01	5.32	0.19	0.04	0.31	−0.27	−0.07	−0.01	0.01	0.18	0.04	−0.05	0.50	17.58
−Q2−Q1	−0.00	−0.01	−0.00	−0.47	0.22	−0.23	−0.02	−0.05	−0.02	0.63	−0.02	−0.16	−0.08 *	0.03	−1.53	48.01
−Q1−Q0	0.06	0.06	0.03	−1.38	0.42	0.43	−0.05	0.71	0.15 **	−0.57	−0.00	0.39 **	0.04	0.07 *	0.55	33.63
Q0+Q1	−0.04	−0.04	−0.00	0.22	−0.30	−0.81 **	−1.79 **	−2.18 **	−0.06	−0.45	0.01	−0.07	−0.15 **	0.02	−0.11	19.94
+Q1+Q2	−0.01	−0.00	0.00	3.01	−0.28 *	−0.18	−0.51	0.77	−0.03	1.24	−0.02	−0.02	−0.04	0.05	2.22 **	50.94 *
+Q2+Q3	0.05	0.03	0.03	−1.27	0.15	−0.02	−0.54	−0.53	0.06	0.09	0.01	−0.09	−0.07	0.17	0.02	87.11 **
+Q3+Q4	0.00	0.01	0.02	2.74	−0.10	−0.33	−0.88 **	0.89	−0.02	−0.87	0.02 *	−0.02	0.02	−0.02	0.03	45.30
+Q4+Q5	−0.05	−0.03	−0.01	−0.35	0.44	−0.13	0.79	−0.41	−0.10	−0.89	0.01	−0.20 *	−0.07	−0.02	−0.74	34.61
+Q5+Q6	−0.01	−0.00	−0.04 ***	−2.54 **	0.43 *	−0.15	0.42	−0.38	0.09	0.29	−0.04	−0.13	−0.07	−0.08	−0.78	36.24
+Q6+Q7	0.04	0.01	0.03	0.33	−0.38 *	0.17	−0.15	0.38	0.04	1.05 *	0.06	−0.20 **	0.01	0.07	0.10	90.66
+Q7+Q8	0.00	−0.02	−0.04 *	−0.26	−0.08	−0.09	−0.84	0.59	−0.03	−0.35	0.02	0.08	0.03	−0.02	−0.31	−75.41

This table shows the mean differences in the low-deal-value acquired target companies' financial ratios for successive quarters. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively. CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NFAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

Table 11. Paired-Sample High-Deal-Value Mean Differences Across Various Financial Metrics.

Comparison	CR	QR	CaR	LTD/E	NOPAT/S	ROA	ROE	PM	Z	ICR	ATR	ITR	NEAT	P/B	P/E	MCap (\$M)
−Q20−Q19	0.02	0.03	0.03	−0.32	0.06	0.43 *	0.82	0.04	0.06	0.25	0.00	−0.18	−0.01	0.02	0.09	−19.06
−Q19−Q18	−0.03	−0.05	−0.03	−1.26	−0.51	0.06	0.40	−0.95 *	−0.01	−0.28	0.00	0.01	−0.05	0.06	−0.62	−8.35
−Q18−Q17	−0.02	−0.06 ***	−0.03 **	2.50	−0.43	0.01	−0.22	0.66	−0.05	0.10	−0.01 *	−0.11	−0.00	0.01	−0.58	35.87
−Q17−Q16	−0.03	−0.02	−0.03	0.55	−0.13	0.00	0.19	0.40	−0.11 **	−0.10	−0.01	−0.01	−0.01	−0.18 **	0.03	−7.91
−Q16−Q15	0.05 **	0.05 **	0.04 *	0.22	−0.07	−0.16	−0.85	−0.54	0.07	−0.61	0.01	0.01	0.11 *	−0.10 **	0.01	−55.77
−Q15−Q14	−0.03	−0.00	0.01	−1.65	−0.18	−0.16	−0.69	0.00	0.05	0.22	0.01	0.01	0.03	0.00	−0.10	118.56
−Q14−Q13	0.00	0.00	−0.01	2.11	0.35	−0.03	−0.26	−0.39	−0.05	0.14	−0.03 ***	0.05	−0.06	0.03	0.69	−61.49
−Q13−Q12	−0.03	−0.02	−0.00	−0.01	0.00	−0.20	−1.15	0.45	0.09	−0.40	−0.01	−0.23	−0.06	−0.08	0.41	109.32 *
−Q12−Q11	0.02	0.02	0.02	−0.81	−0.05	0.39	0.24	0.35	−0.12	0.45	−0.00	0.15	0.04	0.02	−0.25	99.29 **
−Q11−Q10	−0.02	0.01	0.00	−1.09	0.09	−0.18	−2.37 **	−1.55	0.03	−0.54	−0.00	0.00	−0.01	0.07	0.40	14.74
−Q10−Q9	0.05 **	−0.01	0.00	0.45	0.03	−0.13	−0.06	0.80	−0.05	−0.34	−0.01	−0.01	0.05	0.02	−0.56	55.37
−Q9−Q8	−0.05	−0.02	−0.01	−0.77	0.08	0.20	−0.01	0.75	−0.02	−0.38	−0.00	−0.19 *	0.03	0.02	0.51	62.47
−Q8−Q7	−0.02	−0.03	−0.02	0.61	0.00	−0.17	0.41	−0.32	0.00	0.47	−0.00	0.07	−0.01	0.03	0.00	35.83
−Q7−Q6	0.01	0.01	0.02	−3.13	0.08	0.39 *	2.82 *	0.01	0.00	0.31	−0.00	0.08	−0.13	−0.02	0.70 **	89.24 *
−Q6−Q5	0.02	0.01	0.03	2.69	−0.01	−0.18	−0.40	−0.10	0.03	−0.92	−0.00	0.06	0.07	0.04	0.95	226.93 **
−Q5−Q4	−0.05	−0.03	−0.03	2.24	0.12	0.35	0.14	1.33 **	−0.02	0.66	−0.01 **	−0.15	−0.07	0.00	−0.08	−15.24
−Q4−Q3	0.03	0.03	0.02	2.93	0.01	−0.14	−0.44	−1.19 *	−0.05	−0.32	−0.01	0.10	−0.05	0.06	0.57	−28.18
−Q3−Q2	−0.02	−0.00	0.00	0.64	−0.37	−0.44	−1.96	−0.34	0.09	−0.48	−0.00	−0.04	−0.07	−0.07	0.32	116.29
−Q2−Q1	−0.00	−0.00	0.00	1.93	0.11	0.36	0.33	0.33	−0.20	−0.03	0.00	−0.13	−0.02	−0.01	0.43	140.66
−Q1−Q0	−0.03	−0.03 *	−0.03	−1.63	−0.20	−0.48	0.11	−0.11	0.06	0.12	−0.00	−0.00	0.04	0.06	1.35	94.75
Q0+Q1	0.02	0.01	0.03	7.17	−0.05	0.07	−1.08	0.51	−0.14 *	0.10	−0.03 ***	−0.05	−0.14	−0.08	0.31	324.44 *
+Q1+Q2	−0.03	−0.04	−0.03	−2.17	0.42	0.24	0.18	−1.14	−0.11	−1.00 **	−0.00	−0.03	0.04	−0.08	0.15	335.02 *
+Q2+Q3	0.01	0.02	0.00	2.18	−0.50	−0.60 **	−2.21 **	−0.21	0.00	−0.34	−0.01	−0.21	−0.08	−0.19	0.04	414.43 **
+Q3+Q4	−0.04	−0.07 **	−0.06 *	−2.87	−0.79	−0.21	−0.59	0.07	−0.06	−0.33	−0.01	0.15	0.02	0.09	0.12	174.55
+Q4+Q5	0.01	0.00	−0.01	2.09	−0.03	−0.42 **	−0.34	0.87	−0.00	0.73	−0.02 *	0.29	0.04	0.03	0.86	6.73
+Q5+Q6	0.00	−0.01	0.00	3.75 **	−0.20	0.04	0.03	−1.45 **	0.00	−0.34	0.01 **	0.31	0.08 *	0.02	1.09	196.36
+Q6+Q7	−0.01	0.00	−0.00	−3.75 *	0.03	−0.00	0.10	−0.43	0.14	0.84 *	−0.00	−0.37	−0.06	−0.02	1.41 *	469.81 ***
+Q7+Q8	0.02	0.02	0.01	−0.18	0.73 *	0.40 *	0.06	1.10	0.01	−0.45	−0.00	−0.08	0.03	0.01	0.41	−114.10

This table shows the mean differences in the high-deal-value acquired target companies' financial ratios for successive quarters. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively. The table includes various financial metrics, such as CR = current ratio; QR = quick ratio; CaR = cash ratio; LTD/E = long-term debt to equity; NOPAT/S = net operating profit after tax to sales; ROA = return on assets; ROE = return on equity; Z-Score = Altman Z-score; ICR = interest coverage ratio; ATR = asset turnover ratio; ITR = inventory turnover ratio; PM = profit margin; NEAT = net fixed asset turnover; P/B = price-to-book ratio; P/E = price-to-earnings ratio; MCap (\$M) = market capitalization, in millions.

4.5. Comparisons of Expected Values and Actual Values of the Financial Ratios of Target Companies

Although this paper does not focus on forecasting, we provide insight by comparing the actual financial ratios of the target companies during the 20 quarters following the announcement with their expected ratios. The expected values are calculated as the average financial ratios of the target companies over the eight quarters preceding the announcement. This analysis was conducted for target companies involved in low-value, high-value, cash-based, and non-cash-based acquisitions. The *t*-statistics from the independent *t*-tests with unequal variances are presented in Tables 12–15, respectively.

Table 12. Independent *t*-Test Results for the Mean Differences in the Expected and Actual Values of the low-deal-value acquisitions after the announcement.

Financial Ratio	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Current Ratio	0.62	0.68	0.36	0.36	0.67	0.71	0.46	0.40
Quick Ratio	0.92	0.93	0.65	0.55	0.84	0.84	0.77	0.96
Cash Ratio	0.72	0.59	0.24	0.18	0.24	0.73	0.41	0.98
LT Debt to Equity	0.66	0.41	0.46	0.31	0.34	0.51	0.47	0.51
NOPAT to Sales	0.91	0.71	0.84	0.79	0.86	0.57	0.83	0.87
ROA	0.55	0.95	0.80	0.68	0.67	0.89	0.85	0.91
ROE	0.93	0.77	0.68	0.27	0.44	0.62	0.90	0.61
Altman Z	0.92	0.94	0.81	0.91	0.97	1.00	0.88	0.96
Interest Coverage	0.43	0.58	0.90	0.96	0.67	0.71	0.69	0.66
Asset Turnover	0.58	0.78	0.63	0.42	0.43	0.79	0.33	0.24
Inventory Turnover	0.82	0.91	0.97	0.93	0.75	0.46	0.63	0.91
Profit Margin	0.33	0.83	0.49	1.00	0.72	0.49	0.64	0.81
Net Fixed Asset Turnover	0.77	0.73	0.73	0.78	0.83	0.71	0.62	0.59
Market Cap	0.68	0.54	0.40	0.35	0.32	0.32	0.23	0.27
PB Ratio	0.87	0.55	0.25	0.17	0.19	0.36	0.42	0.58
PE Ratio	0.91	0.26	0.24	0.25	0.47	0.65	0.47	0.68

Mean differences in the expected and actual values figures of the target companies' financial ratios for the low deal values after the announcement.

Table 13. Independent *t*-Test Results for the Mean Differences in the Expected and Actual Values of the high-deal-value acquisitions after the Announcement.

Financial Ratio	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Current Ratio	0.46	0.24	0.29	0.1 *	0.11 *	0.13 *	0.1 *	0.15
Quick Ratio	0.66	0.34	0.49	0.06 **	0.06 **	0.06 **	0.07 *	0.13 *
Cash Ratio	0.69	0.92	0.92	0.22	0.14	0.17	0.15	0.24
LT Debt to Equity	0.09 *	0.18	0.12 *	0.21	0.14	0.06 **	0.15	0.17
NOPAT to Sales	0.80	0.88	0.72	0.29	0.28	0.26	0.24	0.52
ROA	0.99	0.59	0.58	0.46	0.54	0.33	0.62	0.69
ROE	0.47	0.38	0.03 **	0.02 **	0.01 ***	0.01 **	0.02 **	0 ***
Altman Z	0.51	0.26	0.19	0.15	0.12 *	0.1 *	0.26	0.26
Interest Coverage	0.31	0.37	0.13	0.23	0.24	0.12 *	0.45	0.17
Asset Turnover	0.08 *	0.07 *	0.05 **	0.03 **	0.01 ***	0.02 **	0.02 **	0.02 **
Inventory Turnover	0.93	0.93	0.36	0.53	0.79	0.91	0.72	0.66
Profit Margin	0.67	0.58	0.41	0.57	0.94	0.29	0.17	0.59
Net Fixed Asset Turnover	0.88	0.90	0.42	0.62	0.64	0.79	0.81	0.74
Market Cap	0.06 **	0.04 **	0.02 **	0.01 ***	0.01 **	0.01 ***	0.01 ***	0.01 ***
PB Ratio	0.78	0.89	0.52	0.28	0.51	0.58	0.77	0.97
PE Ratio	0.05 **	0.04 **	0.04 **	0.04 **	0.02 **	0.01 ***	0.01 ***	0.01 ***

The mean differences in the expected and actual values of target companies' financial ratios for the high-deal-value acquisitions after the announcement. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively.

Table 14. Independent *t*-Test Results for the Mean Differences in the Expected and Actual Values of the Cash-Based Acquisitions after the Announcement.

Financial Ratio	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Current Ratio	0.90	0.95	0.61	0.69	0.74	0.68	0.41	0.49
Quick Ratio	0.96	0.74	0.87	0.75	0.99	0.98	0.79	0.88
Cash Ratio	0.70	0.88	0.65	0.45	0.56	0.88	0.49	0.93
LT Debt to Equity	0.28	0.21	0.21	0.17	0.16	0.16	0.21	0.28
NOPAT to Sales	0.98	0.73	0.95	0.90	0.80	0.33	0.52	0.73
ROA	0.64	0.85	0.93	0.86	0.57	0.32	0.27	0.44
ROE	0.96	0.71	0.49	0.56	0.72	0.94	0.58	0.97
Altman Z	0.72	0.91	0.44	0.38	0.43	0.53	0.58	0.50
Interest Coverage	0.36	0.78	0.65	0.62	0.65	0.76	0.93	0.31
Asset Turnover	0.60	1.00	0.98	0.85	0.71	0.77	0.96	0.68
Inventory Turnover	0.96	0.67	0.75	0.93	0.65	0.36	0.53	0.82
Profit Margin	0.94	0.82	0.45	0.89	1.00	0.59	0.29	0.93
Net Fixed Asset Turnover	0.92	0.90	0.69	0.77	0.77	0.96	0.78	0.69
Market Cap	0.43	0.34	0.22	0.15	0.15	0.09 *	0.06 **	0.07 *
PB Ratio	0.71	0.55	0.29	0.23	0.21	0.33	0.50	0.48
PE Ratio	0.69	0.18	0.19	0.18	0.26	0.29	0.24	0.35

The mean differences in the expected and actual values of the target companies' financial ratios for the cash-based acquisitions after the announcement. **, and * indicate significance at the 0.05, and 0.1 levels, respectively.

Table 15. Independent *t*-Test Results for the Mean Differences in the Expected and Actual Values of the Non-cash-based Acquisitions after the Announcement.

Financial Ratio	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Current Ratio	0.69	0.47	0.49	0.25	0.07 *	0.06 *	0.03 **	0.1 *
Quick Ratio	0.74	0.57	0.64	0.04 **	0.05 **	0.04 **	0.02 **	0.03 **
Cash Ratio	0.70	0.83	0.63	0.26	0.15	0.07 *	0.03 **	0.11 *
LT Debt to Equity	0.29	0.40	0.28	0.42	0.34	0.27	0.39	0.35
NOPAT to Sales	0.71	0.86	0.59	0.12 *	0.20	0.08 *	0.09 *	0.36
ROA	0.94	0.78	0.22	0.06 **	0.03 **	0.02 **	0.04 **	0.08 *
ROE	0.23	0.36	0.03 **	0 ***	0 ***	0 ***	0 ***	0 ***
Altman Z	0.26	0.18	0.08 *	0.06 **	0.09 *	0.14	0.24	0.40
Interest Coverage	0.20	0.57	0.03 **	0.01 ***	0.19	0.11 *	0.21	0.43
Asset Turnover	0.16	0.22	0.22	0.22	0.56	0.16	0.61	0.50
Inventory Turnover	0.88	0.68	0.43	0.56	0.98	0.53	0.96	0.72
Profit Margin	0.65	0.24	0.45	0.40	0.80	0.18	0.44	0.77
Net Fixed Asset Turnover	0.92	0.73	0.91	0.89	0.92	0.87	0.90	0.97
Market Cap	0.08 *	0.05 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **	0.02 **
PB Ratio	0.97	0.98	0.27	0.11 *	0.17	0.23	0.59	0.62
PE Ratio	0.08 *	0.07 *	0.05 **	0.06 **	0.03 **	0.03 **	0.02 **	0.02 **

The mean differences in the expected and actual values of the target companies' financial ratios for the non-cash-based acquisitions after the announcement. ***, **, and * indicate significance at the 0.01, 0.05, and 0.1 levels, respectively.

The results indicate that for the low-value acquisitions, there were no significant differences between the expected and actual values for any of the financial ratios. Similarly, the cash-based deals showed no significant differences, except for the market capitalization figures in three quarters. This suggests that low-value and cash-based deals can be reliably predicted by averaging the pre-deal figures.

In contrast, the high-value acquisitions and non-cash-based deals exhibited a different pattern. While approximately one-fourth of the financial ratios experienced significant changes after the deal—indicating that the pre-deal averages are generally poor predictors during the first three quarters—the financial landscape tended to realign with the pre-deal figures over time. However, no consistent generalization can be made regarding the types of financial ratios affected.

4.6. Discussion

The results of this study support prior findings in the literature regarding the advantages of cash-based acquisitions. For example, Kalsie and Singh (2022) highlight that cash payments in M&As positively impact operational and financial synergies, particularly in developing markets. Similarly, the phenomenon of non-cash acquisition premia (Alsharairi et al. 2016; Mueller and Sirower 2003) suggests that non-cash deals often fail to create immediate financial improvements because of their complex nature and the potential dilution of the share value. In line with these studies, our findings demonstrate that cash acquisitions tend to enhance liquidity and profitability ratios more effectively in the short to medium terms. This could be attributed to the direct infusion of cash, which facilitates a smoother operational integration and financial management.

This study's insights into deal values reveal that low-deal-value acquisitions yield better financial outcomes for target companies, especially regarding liquidity and profitability ratios. These findings are in line with Vayner and Rogova (2022), who observed that acquisitions involving financially weaker or smaller targets are often more successful. Our research extends this perspective by showing that low-deal-value acquisitions improve the shareholder value more rapidly, as evidenced by the positive changes in the market capitalization and market ratios post-acquisition. This suggests that low-deal-value targets are more adaptable to operational restructuring, resulting in faster financial recovery and growth.

Conversely, the negative trends observed for the high-deal-value acquisitions, particularly in the profitability and asset management ratios, are consistent with the findings of Okofo-Dartey (2021), who noted that large-scale transactions often face greater integration challenges and financial stress. While high-deal-value acquisitions may provide long-term strategic benefits, they initially place a burden on financial performance, highlighting the importance of robust post-acquisition management.

Another novel aspect of this study is its comparative evaluation of cash vs. non-cash acquisitions and low-deal-value vs. high-deal-value acquisitions. While previous studies (e.g., Erel et al. (2015) and Cheng et al. (2022)) have explored the aspects of payment method and deal size, this research uniquely integrates these dimensions to uncover their combined effects on target companies' financial performance. For instance, the finding that cash acquisitions outperform non-cash deals in terms of liquidity and profitability underscores the importance of payment methods in shaping post-acquisition outcomes. Similarly, the evidence favoring low-deal-value acquisitions highlights the strategic advantages of targeting smaller or less financially demanding companies.

5. Conclusions

In conclusion, this study provides a comprehensive analysis of the financial performance of target companies before and after an acquisition. Our investigation, utilizing a vast dataset and a variety of financial ratios, sheds light on the nuanced impacts of M&A transactions on target firms. We found that liquidity ratios, profitability measures, asset management ratios, and market valuations exhibit significant changes in the specific pre- and post-acquisition periods, offering insights into the complex dynamics at play.

Our findings suggest that the method of acquisition, whether through cash or non-cash transactions, and the size of the deal, whether a high-value or low-value deal, play critical roles in influencing the post-acquisition financial performance of target companies. The cash acquisitions, in particular, exhibited distinct patterns in the liquidity, profitability, and asset management ratios compared to the non-cash deals, highlighting the importance of the payment method in M&A outcomes, which is in harmony with the findings of Kalsie and Singh (2022). Our look into how profitable these companies are and how they manage their assets shows that cash deals tend to work out better in the short to medium terms, which is in alignment with the phenomenon called non-cash acquisition premia in the literature (Alsharairi et al. 2016; Mueller and Sirower 2003). This might be because acquiring companies are directly investing in cash, which can make operations more efficient and

lead to better integration. On the other hand, deals that proceed without cash might not lead to direct improvements in financial ratios because of the complicated nature of these transactions and the potential impact on the value of the shares.

Moreover, low-deal-value acquisitions tend to be more beneficial for the target companies in the short to medium terms, particularly by enhancing the liquidity and profitability ratios. The positive effect of low-deal-value acquisitions on market capitalization and other market ratios, observed a few quarters post-acquisition, underscores the advantage of these transactions in increasing shareholder value efficiently. Conversely, high-deal-value acquisitions initially reduced financial performance, as indicated by the relative decrease in the profitability ratios. High-deal-value acquisitions can initially stress financial metrics, but these deals might offer long-term benefits that are worth a closer look.

Our study provides a framework for acquirer companies in choosing target companies in terms of the size of the company and the payment method. Choosing lower-deal-value companies and making cash payments instead of higher-deal-value companies and making non-cash payments can offer advantages by affecting target companies' financial success within a short period of time. Acquirer companies should also be aware that debt ratios and Altman Z-scores take longer for changes to occur, and even for low-deal-value and non-cash payment transactions, paying attention to the financial distress and capital structure results in benefits.

Overall, the results are quite similar for the comparison of the cash and non-cash target companies and the low-deal-value and high-deal-value target companies. In terms of the financial ratios, such as liquidity, profitability, and asset management, the cash and low-deal-value target companies outperformed their counterparts. In checking the market ratios and, especially, the market cap, all target companies performed relatively well after the acquisition. This is also in line with the literature (see Carow et al. 2004; Chatterjee et al. 1992; Fowler and Schmidt 1988), in which target companies performed well in stock markets after the acquisition. Although it was not our main research focus, we appreciate the literature that focused on stock market performance.

The findings of this study have practical implications for acquirer companies. By demonstrating the financial benefits of cash acquisitions and low-deal-value targets, this research provides actionable insights for crafting effective acquisition strategies. Acquirers are advised to prioritize smaller deal values and cash-based transactions to achieve better financial outcomes in the short to medium terms. Furthermore, attention should be given to financial distress indicators, such as debt ratios and Altman Z-scores, which may take longer to improve but are critical for long-term success.

While this study offers valuable insight, it has certain limitations. The dataset, although extensive, is limited to publicly available financial statements and excludes private target companies whose post-acquisition data might provide additional perspectives. Additionally, the analysis focuses on a 29-quarter timeline, which may not capture the long-term effects of M&A transactions.

Future research could address these limitations by incorporating private companies and extending the timeline to evaluate the long-term financial impact of acquisitions. Moreover, exploring the role of industry-specific factors and macroeconomic conditions can provide a more contextual understanding of M&A outcomes. Finally, integrating qualitative data, such as managerial strategies and cultural integration practices, can offer a holistic view of the factors driving M&A success.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/jrfm17120581/s1>, Table S1: Research Data.

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Article

ESG Performance and Corporate Governance—The Moderating Role of the Big Four Auditors

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Abstract: The purpose of this study is to investigate the impact of corporate governance on ESG performance in large publicly listed firms in Indonesia from 2016 to 2023. The study adopts both stakeholder-agency theory and resource dependency theory to explore the relationship between sustainability assurance, board governance characteristics, and the extent of ESG performance. Fixed effects regression controlling both industry and year fixed effects is used to measure the relationship between sustainability assurance, corporate governance characteristics, and ESG performance. We find a positive significant relationship between assurance sustainability reports and ESG performance. Additionally, we also document a positive association between sustainability committees and ESG performance. Adopting the Big Four auditors as a moderating variable, we find a positive relationship between gender-diverse boards and firms audited by the Big Four auditors and sustainability performance. This result suggests that firms with gender-diverse boards audited by the Big Four auditors enhance sustainability performance. Additional robustness tests using GMM estimation, conducted to address endogeneity concerns, corroborated the main test results.

Keywords: ESG; sustainability assurance; gender diversity; sustainability committee; stakeholder-agency theory

1. Introduction

Globally, corporations are addressing wide-ranging sustainability challenges by exhibiting firm commitment to comply with current sustainability standards and practices. The calls for transparency and accountability, especially in the domain of environmental, social, and governance (ESG), continue to permeate in developing countries, particularly Indonesia, being one of the most populous countries in the world. In 2015, 17 Sustainability Development Goals (SDG) promoted by the United Nations underscored the significance of governance, social, and environmental issues that exist universally (GRI, 2018). To explicitly and accurately inform stakeholders regarding their ESG activities, frameworks used by entities to report sustainable and ESG practices are essential (Schaltegger et al., 2017). For institutional investors who are predisposed to sustainable and green investments, climate risks potentially have an adverse impact on financial returns (Krueger et al., 2020). Moreover, Albitar et al. (2020) find that the long-term success of an entity is contingent on its capability to manage ESG-related challenges.

There has been an escalation of academic research in the sustainability space, particularly in the developing countries in the Asia Pacific and Southeast Asia. Buniamin et al. (2020) document a positive relationship between gender diversity, firm size, and board size with SDG initiatives in listed Malaysian firms. Additionally, Jan et al. (2023) found that companies with Islamic corporate sustainability practices aligned with the SDGs in Malaysian and Indonesian firms are associated with better financial performance. In a separate study, Susilowati et al. (2022) document higher levels of corporate governance disclosures in Malaysian Fintech companies in comparison to Indonesian Fintech companies. Moreover, another comparative study between Japan and Indonesia documents a distinct difference in their governance systems in achieving the SDGs (Morita et al., 2020).

Indonesia is chosen as the country for this study for the following reasons. In Indonesia, the recent movement in the legislative and regulatory landscape specifically around environmental, social, and governance (ESG) space has encouraged many organizations to embrace sustainability (IDX, 2020). The advent of sustainability initiatives encompassing the SDGs and GRI frameworks assessing company climate change and critical sustainability practices propel a global movement towards corporate social responsibility (GRI, 2018). Chitimiea et al. (2021) found that investors are more likely put their money in firms that espouse sustainability practices, with green investments escalating expeditiously. Globally, stakeholders are demanding transparency on ESG activities emphasizing global warming, social hazards, and governance challenges (KPMG, 2022). These international trends have resulted in Indonesian corporations focusing and overseeing ESG risks associated with social inequality and environmental and governance issues. Indonesian entities can avoid these risks and benefit by providing fair and equitable labor practices, reducing environmental threats, and promoting strong governance reforms (IDX, 2020). On 8 March 2023, the Indonesia Stock Exchange (IDX) highlighted the importance of gender equality by organizing the “Ring the Bell for Gender Equality” event to increase awareness of the role and opportunities of women in the corporate sector. Consequently, ESG-conscious entities are able to compete internationally and successfully with global brands and other industry players (KPMG, 2022). Research on the requirements for sustainability reports to be assured and verified to lend credibility to the disclosures made by organizations commenced in the late nineties (Beets & Souther, 1999). Simnett et al. (2009) argue that entities striving to augment the reliability of their corporate social responsibility (CSR) reports and enhance their corporate reputation tend to have their sustainability reports assured. From a gender diversity perspective, Zampone et al. (2022) found that female directors play a pivotal role in fostering sustainability initiatives. Separately, Bradbury et al. (2022) document a positive association between the presence of a sustainability committee and having an external assessor for the sustainability report. Given the importance of such attributes in cultivating the sustainability agenda, this study emphasizes sustainability assurance, gender-diverse boards, and the existence of sustainability committees in large listed Indonesian firms.

This study makes the following contributions. To the best of our knowledge, this is a novel sustainability study linking sustainability assurance, gender diversity, and sustainability committees together for large, listed firms in Indonesia. Second, this study provides an update on sustainability reporting in Indonesia after the introduction of the United Nations Sustainable Development Goals (UNSDG) in 2015. Third, using a moderating variable, i.e., the Big Four auditors, this paper also investigates whether gender-diverse boards and Big Four auditors have an impact on the ESG performance of firms. While there are ESG studies on corporate governance focusing primarily on board independence, board size, and frequency of board meetings, this research reviews the relevance of sustainability report assurance and the existence of sustainability committees. Moreover, this paper also investigates the importance of the Big Four auditors and gender-diverse boards in uplift-

ing ESG performance. Therefore, this research fills a gap in the literature by examining these distinct governance mechanisms that may affect ESG performance in Indonesian listed firms.

We find a positive association between the assurance of sustainability reports and the ESG performance of large Indonesian listed firms for the period covering 2016 to 2023. We also find a statistically positive and significant relationship between ESG scores and the existence of sustainability committees. Using the Big Four as a moderating factor, we find that gender-diverse boards audited by the Big Four auditors are positively associated with ESG performance.

The remainder of this paper is structured as follows. In Section 2, we review the literature on sustainability assurance, gender diversity, and sustainability committees and develop our hypotheses. In Section 3, we outline the research method. Section 4 descriptive statistics and correlations for the sample are discussed and the results from our main empirical tests with additional analyses are reported. In Section 5, the discussion and conclusion of the paper are presented.

2. Theory, Literature Review, and Hypothesis Development

2.1. Theoretical Framework

For this study, we adopted both stakeholder-agency theory and resource dependency theory as the focal theoretical frameworks. Hill and Jones (1992) argue that a combined theoretical lens is relevant in minimizing the deficiencies of agency and stakeholder theory. Given the inadequate focus on the principal and manager relationship based on agency theory, Zaman et al. (2021) argue that a joint theory approach is more appropriate, particularly for ESG studies involving multiple stakeholders. Adopting stakeholder-agency theory underlines the importance of the entitlements of every stakeholder within the firm and not solely the shareholders (Hill & Jones, 1992). Similarly, Zolotoy et al. (2021) contend that proponents of stakeholder-agency theory mitigate the conflicts between stakeholders. Moreover, Gerged (2020) argue that the theoretical context of stakeholder-agency lessens both internal and external pressures from conflicting interests between the different parties in the nexus of relationships within the firm.

We utilized resource dependency theory to demonstrate the importance and dynamics of female directors in the boardroom. Hillman et al. (2007) found that gender-diverse boards provide greater perspectives in generating alternative solutions. Hillman et al. (2007) argue women have the potential to connect the organizations to different stakeholders in comparison to men. Martinez-Ferrero et al. (2021) found that boards with female representation in emerging economies in South America are associated with higher CSR commitments and accountabilities. Likewise, based on a global study involving 39 companies, Zampone et al. (2022) argue that gender-diverse boards are linked with increased SDG disclosure. Considering that ESG studies involve a myriad of stakeholders, we suggest that both stakeholder-agency and resource dependency theories are applicable to this paper.

2.2. Literature Review and Hypotheses Development

2.2.1. Literature Review on Sustainability Reporting/ESG Performance

The sustainability theme has been ubiquitous on the academic research agenda for last decade, and the propagation of sustainability reporting research after the introduction of the United Nations SDGs in 2015 has been evident (Adams, 2022; Emma & Jennifer, 2021; Garcia-Blandon et al., 2024; Lim et al., 2021; Pranugrahaning et al., 2023; Sorooshian, 2024).

Bose et al. (2024) find that active stakeholder engagement programs, the existence of sustainability committees, and the having a separate sustainability report are three main characteristics of the companies reporting against the UN SDGs framework. Hendratama and Huang (2021) document a positive association between CSR disclosure and firm value, which is contingent on firm life cycle in a study of Southeast Asian firms. Rasanjani (2018) contend that a relevant poverty-reduction program like Zakat, best practices, and novel databases are significant considerations to eradicate poverty in Indonesia. Furthermore, Gunawan et al. (2020) highlight the urgent need for the Indonesian government to harmonize their earmarked SDGs by engaging and communicating with local firms. Comparably, Morita et al. (2020) disclose the challenges that Indonesia confronts in achieving the SDGs, especially in setting the vision and implementation phases.

Najaf et al. (2024) found that independent board members and increased board meetings are associated with better ESG performance in a study of Malaysian listed firms. Additionally, Chebbi and Ammer (2022) found that the board size and board independence of Saudi listed firms are significantly correlated with ESG disclosures. A review of UK listed firms documents the role of female directors in attenuating the adverse impact of earnings management on ESG performance (Adeneye et al., 2024). Separately, Yorke et al. (2023) argue that the presence of female financial experts on audit committees enhances ESG performance in US listed firms. Likewise, a significant positive association was found between audit committee independence and expertise and ESG performance (Pozzoli et al., 2022). Finally, Elamer (2024) argue that the presence of proper corporate governance structures impede ESG controversies and promote ESG growth.

Literature Review—Sustainability Assurance

The surge in sustainable assurance research has expanded in recent years. More countries are acceding to the well-received initiatives of the UN SDGs and sustainability frameworks like the Global Reporting Initiative (GRI) (Al-Shaer & Zaman, 2019; Baboukardos et al., 2021; O'Dwyer, 2011).

Steinmeier and Stich (2019) argue that that sustainability assurance (SA) provided by an auditor is associated with enhanced sustainability investment efficiency. Likewise, a positive relationship between external assurance and the quality of sustainability reporting is evident from research on Malaysian listed firms (Elaigwu et al., 2022). Moreover, Clarkson et al. (2019) document that investors value sustainability reports more when they are assured by the Big Four accounting firms. Additionally, Chapple et al. (2017) found that the benefits of a sustainability committee are linked with higher levels of assurance and the selection of accounting firms as assurance providers. In a separate study, the CSR performance of large US companies was associated with improved financial performance when such companies appointed external CSR assurance (Kim et al., 2019). Nevertheless, one recent study on international assurance suggests that sustainability assurance growth lagged the growth in sustainability reporting (Alsahali & Malagueno, 2022). Finally, Cuadrado-Ballesteros et al. (2017) argue that information asymmetries are only impacted by assurance engagement when provided by accounting professionals with a higher level of assurance. Based on the above literature review, we postulate the following hypothesis:

H1. *Indonesian firms with assured sustainability reports are associated with higher ESG performance.*

Literature Review—Gender Diversity

The view of having females in the boardroom originates from prior research advocating women as being more cautious, principled, and vigilant in contrast to men (Amorelli & Garcia-Sanchez, 2021; Thiruvadi, 2012; Thiruvadi & Huang, 2011).

Zahid et al. (2020) argue that women possess distinct characteristics that may enhance governance processes and manage stakeholders' requirements based on their own experiences and perspectives. Furthermore, because female directors are seen to manage sustainability issues better, having adequate representation on the board will be an asset for an organization (Martinez-Ferrero et al., 2021; Rao & Tilt, 2021). Leaning on resource dependency theory, female directors enable corporations to achieve diverse connections and access to external resources and environments, which are crucial to success (Pfeffer & Salancik, 1978). In a similar vein, Albitar et al. (2020) contend that having women on boards encourages robust decision-making processes. Consequently, Wasiuzzaman and Wan Mohammad (2020) argue that gender-diverse boards are perceived as signaling transparency, accountability, and good governance practices. In contrast, Manita et al. (2018) did not find any association between female directors and CSR disclosure; however, they claim that a higher percentage of women board members is linked with greater sustainability disclosures. Given the overwhelming positive perspectives on gender-diverse boards, the following hypothesis is postulated for this study:

H2. *Indonesian firms with gender-diverse boards are associated with higher ESG performance.*

Literature Review—Sustainability Committee

A study on large multinational corporations emphasized the significance of a sustainability committee in which its members are observed to foster corporate transparency, carry out sustainability policies, and mandate the assurance of sustainability reports (Garcia-Sanchez et al., 2019). From a Southeast Asian perspective, Tran et al. (2020) assert that the presence of a sustainability committee is associated with greater sustainability disclosures. Concurrently, they argue that board diversity and block ownership and board size are the main influences on sustainability disclosures. Li et al. (2022) found that an efficacious sustainability committee enhanced environmental performance in a study of Australian firms. Similarly, Baraibar-Diez and Odriozola (2019) document that firms with CSR committees have higher ESG performance compared to firms without such specialized committees in the case of some European firms. In another study of Italian firms, Spallini et al. (2021) found a positive relationship between the existence of sustainability committees and Global Reporting Index (GRI) scores.

In contrast, although Burke et al. (2019) document that sustainability committees influence sustainability initiatives, their presence alone does not alleviate sustainability risks and concerns. Moreover, Al-Shaer and Zaman (2018) discovered an adverse association between sustainability committees and the assurance of sustainability reports, implying that the formation of such committees burdens smaller entities. Nonetheless, they found that experienced audit committees have an essential task in maintaining the credibility of sustainability reports (Al-Shaer & Zaman, 2018). Considering the above arguments, we propose the following hypothesis:

H3. *Indonesian firms with sustainability committees are associated with higher ESG performance.*

3. Research Methodology

3.1. Sample Selection and Documentation

After standard exclusions, our initial population included 640 firm-year observations for the period 2016 to 2023. We excluded 325 firm-year observations because of missing data in ESG measures, giving a final usable sample of 314 firm-year observations. This study focused on the top 80 listed firms in Indonesia (IDX80) as they are susceptible to higher scrutiny from diverse stakeholders, especially in sustainability/CSR-related disclosures (Cowen et al., 1987; Hackston & Milne, 1996; Watts & Zimmerman, 1978). The period for this study was 2016 to 2023 to ensure an up-to-date state of ESG reporting in Indonesia after the introduction of the United Nations SDGs initiative. ESG scores were downloaded from the London Stock Exchange Group (LSEG) Refinitiv Workspace database, while the remaining data were collected from the Indonesian annual/sustainability reports, which are available publicly on the respective websites.

3.2. Measurement of Dependent Variable—SDGs Disclosure

Aligned with past studies on ESG/sustainability reporting, ESG scores were collected from the LSEG Refinitiv Workspace database, in which three different measurements of ESG are used (Paolone et al., 2022; Pozzoli et al., 2022; Yorke et al., 2023). Once downloaded from Refinitiv database, we captured the ESG score (ESG_SCORE_{it}); the ESG combined score (ESG_COMB_{it}); and the sum of environmental, governance, and social pillar scores (ESG_SUM_{it}). The definitions of these dependent variables are listed under Appendix A.

3.3. Measurement of Independent Variables

3.3.1. Assurance of Sustainability Report

We measured assurance of sustainability reports ($ASSD\_RPT_{it}$) using a dichotomous variable. As an indicator variable, firm i was scored 1 if assured by an independent assurance provider at the end of period t ; otherwise, it was scored 0. This dichotomous measurement has been consistently used in previous research on sustainability assurance (Baboukardos et al., 2021; Bradbury et al., 2022).

3.3.2. Gender Diversity

We measured board gender diversity using a continuous measure (FEM_BOD_{it}). The continuous measure was the percentage of the total number of female directors to the total number of directors on the board. This proxy of gender diversity has been frequently employed in past studies involving female representation on boards of directors (Brahma et al., 2021; Wasiuzzaman & Wan Mohammad, 2020).

3.3.3. Sustainability Committees

We measure sustainability committees (SUS_COM_{it}) using a dichotomous variable of 1 if a sustainability or CSR committee was present and 0 otherwise. This measure has been typically applied in prior studies on sustainability committees (Gallego-Alvarez & Pucheta-Martinez, 2020; Lopez-Arceiz & del Rio, 2022; Zampone et al., 2022).

3.4. Measurement of Control Variables

Consistent with prior literature, we controlled for variables that are associated with corporate governance and ESG reporting (Orazalin, 2019; Zampone et al., 2022). We controlled for the independent directors ($IND\_DIR\%_{it}$), number of board meetings ($MEET\_BOD_{it}$), leverage level (LEV_{it}), firm size (TA_{it}), age of firm (Age_{it}), and whether the firm is audited by one of the Big Four auditors (Big_Four_{it}), as these characteristics may have an influence

on corporate governance and ESG reporting. Definitions for these control variables are provided in Appendix A.

3.5. Regression Model

Regression analyses were performed to examine whether firms with the independent variables indicated earlier have an association with ESG performance.

The first regression equation on ESG_SCORE_{it} concerning sustainability assurance reports, gender diversity, and sustainability committees for every year and industry was run adopting Equation (1), as follows:

$$ESG\_SCORE_{it} = \beta_0 + \beta_1 ASSD\_RPT_{it} + \beta_2 FEM\_BOD_{it} + \beta_3 SUS\_COM_{it} + \beta_4 IND\_DIR_{it} + \beta_5 MEET\_BOD_{it} + \beta_6 LEV_{it} + \beta_7 TA_{it} + \beta_8 Age_{it} + \beta_9 Big\_Four_{it} + \varepsilon_{it} \quad (1)$$

where the variables of interest are $ASSD\_RPT_{it}$, FEM_BOD_{it} , and SUS_COM_{it} ; the coefficient $ASSD\_RPT_{it}$, and FEM_BOD_{it} and SUS_COM_{it} , were projected to be significant in the above ESG_SCORE_{it} model.

The second regression equation on ESG_COMB_{it} relating to sustainability assurance, gender diversity, and sustainability committees for every year and industry was run adopting Equation (2), as follows:

$$ESG\_COMB_{it} = \beta_0 + \beta_1 ASSD\_RPT_{it} + \beta_2 FEM\_BOD_{it} + \beta_3 SUS\_COM_{it} + \beta_4 IND\_DIR_{it} + \beta_5 MEET\_BOD_{it} + \beta_6 LEV_{it} + \beta_7 TA_{it} + \beta_8 Age_{it} + \beta_9 Big\_Four_{it} + \varepsilon_{it} \quad (2)$$

where the variables of interest are $ASSD\_RPT_{it}$, FEM_BOD_{it} , and SUS_COM_{it} . The coefficient $ASSD\_RPT_{it}$, and FEM_BOD_{it} and SUS_COM_{it} , were projected to be significant in the above ESG_COMB_{it} model.

The final regression equation on ESG_SUM_{it} relating to sustainability assurance, gender diversity, and sustainability committees for every year and industry was run adopting Equation (3), as follows:

$$ESG\_SUM_{it} = \beta_0 + \beta_1 ASSD\_RPT_{it} + \beta_2 FEM\_BOD_{it} + \beta_3 SUS\_COM_{it} + \beta_4 IND\_DIR_{it} + \beta_5 MEET\_BOD_{it} + \beta_6 LEV_{it} + \beta_7 TA_{it} + \beta_8 Age_{it} + \beta_9 Big\_Four_{it} + \varepsilon_{it} \quad (3)$$

where the variables of interest are $ASSD\_RPT_{it}$, FEM_BOD_{it} , and SUS_COM_{it} . The coefficient $ASSD\_RPT_{it}$, and FEM_BOD_{it} and SUS_COM_{it} , were projected to be significant in the above ESG_SUM_{it} model.

4. Empirical Results

4.1. Descriptive Statistics and Correlations

Table 1 provides the descriptive statistics of the dependent variables (ESG ratings) and the independent and control variables that were used. The mean aggregate for the ESG_SCORE_{it} is 51.2 with a median of 51.66, whereas the mean and median for ESG_COMB_{it} are 51.05 and 51.61, respectively. For ESG_SUM_{it} , the mean and median are 151.4 and 152.4, respectively. Approximately 33.4% of the firms have their assurance report audited and 15.3% of the firms have gender-diverse boards. Approximately 18.8% of the firms have a sustainability committee whereas the percentage of independent board members is only 5.8%. The boards of directors in large, listed firms meet frequently, as is evident from the average number of 30.17 meetings. The median leverage level of the firms from the sample study is 39.9% and the median of the total assets is USD 2.9 billion. Finally,

the average age of the sampled companies is 46.03 years and approximately 78.0% of the companies are audited by the Big Four auditors.

Table 1. Descriptive statistics of the variables used in the analysis.

	Obs.	Mean	S.D.	P25	Median	P75
Dependent Variables						
<i>ESG_SCORE_{it}</i>	314	51.20	19.71	36.01	51.66	66.71
<i>ESG_COMB_{it}</i>	314	51.05	19.67	36.01	51.61	66.46
<i>ESG_SUM_{it}</i>	314	151.4	60.52	103.5	152.4	201.0
Independent/Control Variables						
<i>ASSD_RPT_{it}</i>	314	0.334	0.473	0	0	1
<i>FEM_BOD_{it}</i>	314	0.153	0.179	0	0.111	0.25
<i>SUS_COM_{it}</i>	314	0.188	0.391	0	0	0
<i>INDEP_DIR%_{it}</i>	314	0.058	0.135	0	0	0.125
<i>MEET_BOARD_{it}</i>	314	30.17	24.43	12	23.5	43
<i>LEV_{it}</i>	314	17.91	181.3	0.129	0.398	0.900
<i>TA_{it}</i> (In Billion USD)	314	13.2	41	1.55	2.9	7.19
<i>Age_{it}</i>	314	46.03	25.22	30	44	57
<i>Big_Four_{it}</i>	314	0.780	0.415	1	1	1
Instrumental Variable						
<i>AUD_IND_{it}</i>	314	0.239	0.690	0	0	0

* *ESG_SUM_{it}* is the sum of the environmental pillar score, social pillar score, and governance pillar score.

Table 2 documents the pairwise Pearson correlation coefficients among all the variables for this research. The table includes the three dependent variables, namely *ESG_SCORE_{it}*, *ESG_COMB_{it}*, and *ESG_SUM_{it}*. Several observations emerge from the analysis of the Pearson correlation matrix in Table 2: First, the three dependent variables are significantly associated with the assurance of sustainability reports (*ASSD_RPT_{it}*) at the 1% significance level. Second, the three ESG scores are not significantly correlated with gender-diverse boards, which was our second independent variable (*FEM_BOD_{it}*). Third, the dependent variables are also positively correlated with sustainability committees, our third independent variable (*SUS_COM_{it}*), at the 1% significance level. Fourth, all the dependent variables are significantly associated with firm size (*TA_{it}*) at the 1% level, suggesting that larger companies tend to pay more attention to ESG initiatives within their organization (Udayasankar, 2008). Table 3 documents the correlation between the dependent, endogenous, and instruments variables that were used in the robustness test of this study, namely the independence of audit committees (*AUD_IND_{it}*). Other than the three dependent variables, which were regressed separately, none of the correlations in the matrix are in excess of the multi-collinearity limit of 0.80 (Hair et al., 1995) and thus we did not find any abnormal correlations among the variables in the regressions that were concerning.

Table 2. Pairwise correlation.

Variables	ESG_SCORE _{it}	ESG_COMB _{it}	ESG_SUM _{it}	ASSD_RPT _{it}	FEM_BOD _{it}	SUS_COM _{it}	IND_DIR _{it}	MEET_BOD _{it}	LEV _{it}	TA _{it}	Age _{it}	Big_Four _{it}
<i>ESG_SCORE_{it}</i>	1											
<i>ESG_COMB_{it}</i>	0.998 ***	1										
<i>ESG_SUM_{it}</i>	0.991 ***	0.989 ***	1									
<i>ASSD_RPT_{it}</i>	0.468 ***	0.461 ***	0.491 ***	1								
<i>FEM_BOD_{it}</i>	−0.002	−0.001	−0.010	0.042	1							
<i>SUS_COM_{it}</i>	0.268 ***	0.267 ***	0.282 ***	0.108 *	−0.019	1						
<i>IND_DIR_{it}</i>	−0.145 **	−0.144 **	−0.145 **	−0.140 **	0.107 *	0.001	1					
<i>MEET_BOD_{it}</i>	0.334 ***	0.333 ***	0.329 ***	0.258 ***	−0.007	−0.082	−0.141 **	1				
<i>LEV_{it}</i>	−0.024	−0.024	−0.021	0.066	−0.013	0.141 **	0.025	−0.072	1			
<i>TA_{it}</i>	0.290 ***	0.285 ***	0.299 ***	0.291 ***	−0.004	−0.078	−0.075	0.111 **	−0.031	1		
<i>Age_{it}</i>	0.369 ***	0.366 ***	0.405 ***	0.369 ***	0.027	0.030	−0.063	0.241 ***	−0.091	0.292 ***	1	
<i>Big_Four_{it}</i>	0.407 ***	0.405 ***	0.396 ***	0.213 ***	0.060	0.078	0.008	0.240 ***	0.011	0.130 **	0.220 ***	1

*, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively. Refer to Appendix A for details of variable definitions.

Table 3. Correlation between dependent, endogenous, and instrument variables.

Variables	ESG_SCORE _{it}	ESG_COMB _{it}	ESG_SUM _{it}	ASSD_RPT _{it}	AUD_IND _{it}
ESG_SCORE _{it}	1				
ESG_COMB _{it}	0.998 ***	1			
ESG_SUM _{it}	0.991 ***	0.989 ***	1		
ASSD_RPT _{it}	0.468 ***	0.461 ***	0.491 ***	1	
AUD_IND _{it}	0.053	0.056	0.059	0.127 **	1

*, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively. Refer to Appendix A for details of variable definitions.

4.2. Multivariate Regression Results

Table 4 describes the main regression results of the relationship between ESG scores and the independent variables of this study, namely the assurance of sustainability reports (*ASSD_RPT_{it}*), gender diversity (*FEM_BOD_{it}*), and the presence of sustainability committees (*SUS_COM_{it}*). The regression results produced an adjusted R² of 51.6%. The R² and adjusted R² results are consistent with some of the prior literature on ESG associated with corporate governance mechanisms (Asante-Appiah & Lambert, 2022).

Table 4. Fixed effects regression—main results.

	(1)	(3)	(5)
Variables	ESG_SCORE _{it}	ESG_COMB _{it}	ESG_SUM _{it}
<i>ASSD_RPT_{it}</i>	6.4881 *** (3.058)	6.2532 *** (2.932)	20.3083 *** (3.184)
<i>FEM_BOD_{it}</i>	0.2566 (0.045)	0.4367 (0.077)	−3.2498 (−0.192)
<i>SUS_COM_{it}</i>	9.3258 *** (4.837)	9.2661 *** (4.708)	30.8439 *** (5.235)
<i>IND_DIR_{it}</i>	−8.7791 * (−1.900)	−8.8098 * (−1.838)	−25.0676 (−1.568)
<i>MEET_BOD_{it}</i>	0.1185 ** (2.449)	0.1219 ** (2.519)	0.3588 ** (2.332)
<i>LEV_{it}</i>	−0.0085 *** (−5.303)	−0.0080 *** (−4.487)	−0.0258 *** (−5.198)
<i>TA_{it}</i>	0.0000 * (1.788)	0.0000 * (1.872)	0.0000 * (1.734)
<i>Age_{it}</i>	0.1288 *** (4.040)	0.1266 *** (3.769)	0.4497 *** (4.740)
<i>Big_Four_{it}</i>	10.5853 *** (4.579)	10.5703 *** (4.576)	30.1416 *** (4.341)
Constant	29.3914 *** (11.401)	29.3139 *** (11.192)	84.1930 *** (10.892)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	314	314	314
R-squared	0.553	0.542	0.580
Adjusted R-squared	0.516	0.504	0.545
F-statistic	23.32	20.73	25.31

Robust *t*-statistics in parentheses. *, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively. Refer to Appendix A for details of variable definitions.

In column 1, we find that the assurance of sustainability reports (*ASSD_RPT_{it}*) is positively and significantly associated across the three dependent variables, namely *ESG_SCORE_{it}*, *ESG_COMB_{it}*, and *ESG_SUM_{it}*, at the 1% significance level, suggesting that the assurance of sustainability reports influences ESG performance. This result is in harmony with the findings of Elaigwu et al. (2022) and Bradbury et al. (2022), claiming that assured sustainability reports enhance the quality of sustainability reporting and

ESG performance. We did not find any significant association between gender-diverse boards and ESG performance across any of the three dependent variables. This result is consistent with Manita et al. (2018), who failed to find any positive relationship between female directors and CSR disclosure, suggesting that only a higher proportion of women on boards promotes sustainability practices. For our third independent variable, we found a positive significant association between sustainability committees (SUS_COM_{it}) and ESG scores. This conclusion is in harmony with previous research on sustainability committees, contending that their existence assists in promoting the sustainability agenda (Cosma et al., 2022; Orazalin, 2019; Zampone et al., 2022).

We also document a significant relationship between ESG performance and the number of board meetings held. This finding is consistent with an earlier study indicating that diligent board members are more in favor of pursuing CSR endeavors (Handayanti et al., 2022). Finally, we also found that companies that engaged the Big Four auditors are associated with higher ESG performance at the 1% significance level across all the dependent variable measurements, implying that experienced and high-quality auditors can also contribute to higher ESG performance. This is in line with the previous findings of Handayanti et al. (2022), from an Indonesian perspective.

4.3. Additional Analyses

Moderation Effect Between Gender-Diverse Boards and the Big Four Auditors

To further examine the ESG performance of large, listed firms in Indonesia, we used a moderating variable, the Big Four auditors, with interaction with board gender diversity. We tested whether gender-diverse boards audited by the Big Four audit firms have any influence on ESG performance. We decided to investigate this interaction effect because the findings of the main test for female directors on ESG performance was not significant. We opined that firms with women on the board are more likely to support sustainability initiatives if they are also audited by the Big Four auditors.

Based on the results depicted in Table 5, the interaction variable of gender-diverse boards and the Big Four auditors is positively associated with the ESG scores. This observation suggests that firms with gender-diverse boards with high-quality and experienced external auditors contribute to better ESG performance. This finding is consistent with the view that there are potential benefits associated with engaging high-quality and experienced external auditors and having gender-diverse boards. These governance traits consequently promote greater sustainability initiatives and practices within an organization (Dakhli, 2021; Zampone et al., 2022).

Table 5. Interaction between gender diversity and the Big Four auditors.

	(2)	(4)	(6)
Variables	ESG_SCORE_{it}	ESG_COMB_{it}	ESG_SUM_{it}
$ASSD\_RPT_{it}$	5.2906 ** (2.540)	5.0635 ** (2.418)	16.5392 *** (2.648)
FEM_BOD_{it}	−28.4431 *** (−3.064)	−28.0743 *** (−3.035)	−93.5777 *** (−3.449)
SUS_COM_{it}	10.0210 *** (5.383)	9.9568 *** (5.232)	33.0321 *** (5.860)
IND_DIR_{it}	−11.9619 *** (−2.695)	−11.9717 *** (−2.633)	−35.0850 ** (−2.450)

Table 5. Cont.

	(2)	(4)	(6)
Variables	<i>ESG_SCORE_{it}</i>	<i>ESG_COMB_{it}</i>	<i>ESG_SUM_{it}</i>
<i>MEET_BOD_{it}</i>	0.1059 ** (2.329)	0.1093 ** (2.404)	0.3189 ** (2.204)
<i>LEV_{it}</i>	−0.0089 *** (−5.475)	−0.0084 *** (−4.658)	−0.0270 *** (−5.410)
<i>TA_{it}</i>	0.0000 * (1.772)	0.0000 * (1.861)	0.0000 * (1.714)
<i>Age_{it}</i>	0.1297 *** (4.206)	0.1275 *** (3.906)	0.4525 *** (4.889)
<i>Big_Four_{it}</i>	4.7406 (1.648)	4.7641 * (1.657)	11.7462 (1.384)
<i>FEM_BOD_{it} × Big_Four_{it}</i>	39.2024 *** (3.695)	38.9445 *** (3.677)	123.3834 *** (4.006)
Constant	34.3390 *** (11.437)	34.2290 *** (11.310)	99.7649 *** (11.226)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	314	314	314
R-squared	0.574	0.563	0.602
Adjusted R-squared	0.537	0.525	0.567
F-statistic	26.35	23.68	29.11

Robust *t*-statistics in parentheses. *, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively. Refer to Appendix A for details of variable definitions.

4.4. Robustness Tests

When investigating the relationships between firms' ESG scores and corporate governance variables, endogeneity and reverse causality are common concerns that may occur. To mitigate these issues, and as a robustness check to validate the main results, we adopted the Generalized Method of Moments (GMM) approach (Wintoki et al., 2012). We considered the variable “independence of audit committee” as the instrumental variable. A valid instrumental variable should meet two criteria: First, it needs to be correlated with the endogenous variable. Second, it should not be correlated with the dependent variable (exogeneity). A preliminary check of the validity of the instrumental variable was conducted using pairwise correlation. Referring to Table 3, we found that the independence of audit committees was significantly correlated with the assurance of sustainability reports at the 5% significance level but was not significantly correlated with any ESG measurement, which satisfies both conditions. As GMM is a dynamic panel model, lagged dependent and independent and control variables were used in the analysis. Fixed effects were not included in the model as these are addressed implicitly by the GMM approach.

Table 6 presents our GMM results. In models (1) to (3), we found a significant positive relationship between the assurance of sustainability reports and firms' ESG scores at the 10% significance level. The existence of sustainability committees also positively affects firms' ESG performance at the 10% significance level for two of the three ESG measures. In addition, we found that the *p*-values for AR (2) in all three models were insignificant, implying that there is no second-order autocorrelation of error terms. The *p*-values for both the Sargan and Hansen tests in all models were above the 10% significance threshold, suggesting that there are no over-identification issues and, hence, supporting the validity of our instruments.

Table 6. GMM analysis.

	(1)	(2)	(3)
Variables	<i>ESG_SCORE_{it}</i>	<i>ESG_COMB_{it}</i>	<i>ESG_SUM_{it}</i>
<i>L.ESG</i>	0.7326 *** (7.604)	0.7100 *** (7.165)	0.7724 *** (7.895)
<i>L.ASSD_RPT_{it}</i>	4.2662 * (1.982)	5.0595 * (2.007)	14.6088 * (1.938)
<i>L.FEM_BOD_{it}</i>	8.7740 (0.809)	8.7712 (0.829)	15.8262 (0.502)
<i>L.SUS_COM_{it}</i>	4.0186 * (1.693)	1.9647 (0.654)	14.9086 * (1.785)
<i>L.IND_DIR_{it}</i>	−9.8169 * (−1.864)	−11.2606 * (−1.934)	−27.2843 ** (−2.102)
<i>L.MEET_BOD_{it}</i>	0.0112 (0.390)	0.0155 (0.725)	0.0060 (0.049)
<i>L.LEV_{it}</i>	−0.0113 ** (−2.668)	−0.0113 ** (−2.275)	−0.0359 ** (−2.637)
<i>L.TA_{it}</i>	0.0000 (0.869)	0.0000 (0.989)	0.0000 (0.368)
<i>L.Age_{it}</i>	0.0182 (0.324)	−0.0060 (−0.096)	0.0971 (0.632)
<i>L.Big_Four_{it}</i>	2.2596 (0.617)	2.4052 (0.665)	1.1012 (0.095)
Constant	9.8493 * (1.890)	11.8454 ** (2.175)	27.2096 * (1.794)
Observations	263	263	263
Number of firms	50	50	50
<i>p</i> -value of AR (1) test	0.003	0.003	0.002
<i>p</i> -value of AR (2) test	0.615	0.330	0.593
<i>p</i> -value of Sargan test	0.549	0.733	0.543
<i>p</i> -value of Hansen test	0.502	0.499	0.346

Robust *t*-statistics in parentheses. *, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively. Audit committee independence was used as an instrumental variable. Refer to Appendix A for details of variable definitions.

To further test the robustness of the main results, we utilized logarithm transformation for leverage (*LN_LEV_{it}*) and total assets (*LN_TA_{it}*) and reran the main analysis. As reflected in Table 7, the results for all the independent variables remained unchanged.

Table 7. Fixed effects regression—main results with logarithm transformation of leverage and total assets.

	(1)	(2)	(3)
Variables	<i>ESG_SCORE_{it}</i>	<i>ESG_COMB_{it}</i>	<i>ESG_SUM_{it}</i>
<i>ASSD_RPT_{it}</i>	7.1592 *** (3.349)	6.9389 *** (3.230)	22.1833 *** (3.468)
<i>FEM_BOD_{it}</i>	−1.0762 (−0.184)	−1.0035 (−0.172)	−6.9429 (−0.398)
<i>SUS_COM_{it}</i>	9.0976 *** (4.643)	9.0367 *** (4.521)	30.3108 *** (5.086)
<i>IND_DIR_{it}</i>	−8.4922 * (−1.877)	−8.5435 * (−1.827)	−23.9033 (−1.536)
<i>MEET_BOD_{it}</i>	0.1046 ** (2.151)	0.1083 ** (2.218)	0.3205 ** (2.080)
<i>LN_LEV_{it}</i>	−1.6109 (−1.336)	−1.6118 (−1.351)	−5.1706 (−1.452)

Table 7. Cont.

	(1)	(2)	(3)
Variables	<i>ESG_SCORE_{it}</i>	<i>ESG_COMB_{it}</i>	<i>ESG_SUM_{it}</i>
<i>LN_TA_{it}</i>	0.0288 (0.039)	−0.0376 (−0.050)	−0.0572 (−0.026)
<i>Age_{it}</i>	0.1390 *** (4.241)	0.1365 *** (3.986)	0.4801 *** (4.934)
<i>Big_Four_{it}</i>	10.5360 *** (4.578)	10.5584 *** (4.594)	29.9341 *** (4.324)
Constant	30.0553 (1.233)	32.0481 (1.318)	90.4977 (1.249)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	313	313	313
R-squared	0.545	0.534	0.574
Adjusted R-squared	0.507	0.495	0.538
F-statistic	17.15	16.41	19.12

Robust *t*-statistics in parentheses. *, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively.

Additionally, to address potential dependence issues in the model, we performed regressions with Driscoll–Kraay standard errors as a robustness check by assuming the presence of cross-sectional dependence (Hoechle, 2007). The main independent variables (*ASSD_RPT_{it}* and *SUS_COM_{it}*) remained statistically significant, as shown in Table 8.

Table 8. Regression with Driscoll–Kraay standard errors.

	(1)	(2)	(3)
Variables	<i>ESG_SCORE_{it}</i>	<i>ESG_COMB_{it}</i>	<i>ESG_SUM_{it}</i>
<i>ASSD_RPT_{it}</i>	6.4881 * (2.338)	6.2532 * (2.311)	20.3083 * (2.185)
<i>FEM_BOD_{it}</i>	0.2566 (0.069)	0.4367 (0.118)	−3.2498 (−0.355)
<i>SUS_COM_{it}</i>	9.3258 ** (3.387)	9.2661 ** (3.295)	30.8439 *** (3.653)
<i>IND_DIR_{it}</i>	−8.7791 ** (−2.398)	−8.8098 * (−2.238)	−25.0676 (−1.754)
<i>MEET_BOD_{it}</i>	0.1185 *** (4.554)	0.1219 *** (4.738)	0.3588 *** (3.915)
<i>LEV_{it}</i>	−0.0085 *** (−7.806)	−0.0080 *** (−8.145)	−0.0258 *** (−7.678)
<i>TA_{it}</i>	0.0000 *** (3.821)	0.0000 *** (3.824)	0.0000 *** (3.814)
<i>Age_{it}</i>	0.1288 ** (3.464)	0.1266 ** (3.072)	0.4497 *** (3.640)
<i>Big_Four_{it}</i>	10.5853 *** (3.521)	10.5703 *** (3.529)	30.1416 *** (3.508)
Constant	14.7703 *** (9.527)	14.0734 *** (7.196)	36.5643 *** (10.448)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	314	314	314
Clusters	51	51	51

Table 8. Cont.

	(1)	(2)	(3)
Variables	ESG_SCORE_{it}	ESG_COMB_{it}	ESG_SUM_{it}
R-squared	0.553	0.542	0.580
Maximum lag	2	2	2
F-statistic	88.67	142.8	122

Robust *t*-statistics in parentheses. *, **, and *** denote two-tailed significance levels at the 10%, 5%, and 1% levels, respectively.

5. Discussion and Conclusions

Impelled by concerns about sustainability issues around the developing world, specifically within Indonesia, we examined whether the assurance of sustainability reports and corporate governance are linked with ESG performance in large public listed firms in Indonesia. We investigated the assurance of sustainability reports, gender diversity, and sustainability committees as they have substantial consequences for social, environmental, and governance matters in large corporations. Using a sample for 314 firm-years for the period 2016 to 2023, we found that firms with assured sustainability reports are positively associated with higher ESG scores. We did not find any association between gender-diverse boards and ESG performance. This phenomenon may have occurred because of the lower percentage of women on corporate boards, as documented in the previous studies of Rosati and Diniz Faria (2019) and Manita et al. (2018). We found a statistically significant positive relationship between the existence of sustainability committees and ESG scores. Additionally, we also found that gender-diverse boards and assurance from the Big Four auditors are positively associated with ESG scores. Our results are robust to alternative measurements of our independent and dependent variables. Additional tests have also addressed the heteroskedasticity and autocorrelation concerns associated with sustainability research.

The results from this study underline the significance and importance of having sustainability reports assured. Additionally, structuring boards to be more ESG/sustainability conscious by assembling a sustainability committee is beneficial to attaining sustainability objectives. Previous studies have linked the importance of having sustainability reports assured and the presence of sustainability committees in uplifting ESG performance (Bradbury et al., 2022; Clarkson et al., 2019). The outcomes from this study may motivate policymakers and standard-setters in Indonesia to consider the benefits of mandating that sustainability reports be verified by an external assurance provider and having a sustainability committee. Additionally, the ramifications of having gender-diverse boards that are audited by one of the Big Four accounting firms should be viewed seriously. These are notable signals to stakeholders and policymakers that both female directors and experienced external auditors can better contribute to ESG performance and sustainability practices. Similarly, policymakers in Indonesia may recommend a minimum quota for women participation on boards considering the prominent role female directors exhibit in sustainability matters. Specifically, the results from this research imply that the assurance of sustainability reports and the existence of sustainability committees are pivotal in achieving the sustainability agenda in Indonesia. From a theoretical viewpoint, our results support both the stakeholder-agency theory and resource dependency theory considering the diverse stakeholders involved.

Comparable to other studies, this research is not without its limitations. First, this study was restricted to Indonesia, the institutional settings of which may vary from another jurisdictions. Second, we focused on the top 80 largest publicly listed firms in Indonesia and not the entire Jakarta Stock Exchange. While we acknowledge that there may be limitations, the strength and valuable implications of the findings cannot be ignored.

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Appendix A. Variable Definition

Variable	Definition	Source
Dependent variables		
ESG_SCORE_{it}	ESG score, with ESG score being an overall company score based on the self-reported information in the environmental, social, and corporate governance pillars.	London Stock Exchange Group (LSEG) Refinitiv Workspace
ESG_COMB_{it}	ESG combined score, with the combined score being the ESG score with an ESG controversies overlay.	LSEG Refinitiv Workspace
ESG_SUM_{it}	Sum of environmental, governance, and social pillar scores. The environmental pillar measures a company's impact on living and non-living natural systems, including the air, land, and water as well as complete ecosystems. The corporate governance pillar measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders. The social pillar measures a company's capacity to generate trust and loyalty with its workforce, customers, and society through its use of best management practices.	LSEG Refinitiv Workspace
Independent Variables		
$ASSD\_RPT_{it}$	Assurance of sustainability report, score = 1, otherwise 0.	Annual Report
FEM_BOD_{it}	Percentage of female on the board.	Annual Report
SUS_COM_{it}	Existence of sustainability committee, score = 1, otherwise 0.	Annual Report

Variable	Definition	Source
Control variables		
<i>INDEP_DIR</i> _{it}	Percentage of independent directors on the board.	Annual Report
<i>MEET_BOARD</i> _{it}	Annual number of meetings for the board of directors.	Annual Report
<i>LEV</i> _{it}	Ratio of book value of debt and book value of total assets.	Annual Report
<i>TA</i> _{it}	The total assets of the firm.	Annual Report
<i>Age</i> _{it}	Number of years from the time of incorporation of the firm.	Annual Report
<i>Big_Four</i> _{it}	Companies audited by the Big Four audit firms, score = 1, otherwise 0.	Annual Report

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Article

The Call to Shift from the Narrow Legalistic to the Broader Moral and Legal Stakeholder Model in Indonesian State-Owned Enterprises: Its Implications and Challenges

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Abstract: This article aims to elaborate on the narrow legalistic stakeholder model and the need to apply a new revised moral and legal stakeholder model in Indonesian state-owned enterprises (SOEs) with its implications and challenges. Studies on the narrow legalistic stakeholder model in Indonesian SOEs are still uncommon, despite the rising awareness of the model. This study expects to initiate discourse on the ideal stakeholder model in the industry. This study combined doctrinal and empirical legal research methods. The SOE laws and the Minister of SOEs' regulations were examined aside from the investigation of empirical data on the accusation of SOEs breaching their obligations to their legitimate stakeholders as indicated in court decisions and mass media publications. This study shows that the Minister of SOEs' Regulation on Implementing Corporate Governance Implementation has promoted a narrow legalistic approach to the stakeholder model. As a result, only those who have a written contract with SOEs can be considered as the legitimate direct stakeholders. This approach has led to the expropriation of other indirect legitimate stakeholders of the SOEs. This study can be used to revise the narrow legalistic stakeholder model and to strengthen research on the stakeholder model in SOEs and corporate governance.

Keywords: Indonesian SOEs; stakeholder model; legalistic; broader; narrow; moral

1. Introduction

Indonesian state-owned enterprises (SOEs) finally adopted the stakeholder model to be implemented in the industry in 2011. The adoption was a bit late, as the stakeholder model has been widely accepted since its introduction in 1984 (Freeman, 1984). However, this step was a breakthrough for Indonesian SOEs, including state-owned banks, as they have been managed under the long-time dominance of shareholder primacy (Sayidah et al., 2019; Fitzpatrick, 1998; Kameyama et al., 2006; Radelet & Sachs, 2000; Claessens & Fan, 2002) that to some extent contributed significantly to the financial crisis and crony capitalism in 1999 (Hughes, 1999; Brown, 2006; Hughes, 2007; Wicaksono, 2008).

The adoption of the stakeholder model in Indonesian SOEs was stated in the Minister of SOEs' Regulation in 2011. It is stipulated that 'Stakeholders are parties that have a stake in SOEs as they have a legal relationship with SOEs' (Art 1(8) Minister of SOEs' Regulation of 2011). The Minister of SOEs' Regulation simply requires that Indonesian SOEs acknowledge that their stakeholders have a legal relationship with them. This means that stakeholders are recognized under a narrow legalistic approach. There is no further explanation on this definition.

Such a conception creates several critical questions, such as: What does the narrow legalistic stakeholder model look like? What are the implications of the narrow legalistic

stakeholder model both for Indonesian SOEs themselves and for their legitimate stakeholders that do not have a legal contract with them? What should be the ideal stakeholder model in Indonesian SOEs? What challenges would be faced by Indonesian SOEs in implementing the ideal stakeholder model? Unfortunately, these issues are not addressed properly in the Minister of SOEs' Regulation of 2011 in the implementation of good corporate governance in SOEs. Consequently, it is pertinent to investigate what needs to be done to overcome these problems.

Therefore, this study critically examines the weaknesses of the existing regulations and provides several sound normative, conceptual, and practical frameworks for Indonesian SOEs in implementing the stakeholder model. This study is also vital as a narrow legalistic stakeholder model in SOEs has not been carried out before. However, it should be acknowledged that some studies have also been conducted in exploring the roles of stakeholders and corporate governance standards and the stakeholder model in the Indonesian banking sector (Rissy, 2018, 2019b, 2021a, 2021b, 2021c). Other studies have also been carried out in relation to the concept and application of the stakeholder model in broader companies in Indonesia (Spitzeck & Hansen, 2010; Ramadhini et al., 2020).

Even the latest research related to the application of stakeholder theory in Indonesia from 2023 to 2024 does not discuss the issues that are addressed in this research. These studies, for example, examine firm performance in state-owned enterprises in Indonesia (Sulastri & Muizuddin, 2024); social, environmental, and governance practices perspective (Salman et al., 2024); sustainability accounting (Manalu et al., 2023); and corporate social responsibility and financial performance in Indonesia's mining industry (Husnah & Fahlevi, 2023).

Hence, so far, it is evident that none of the previous and latest studies dealt with the narrow legalistic stakeholder model in Indonesian SOEs and its implications and challenges faced by Indonesian SOEs in implementing the stakeholder model. This study, hence, attempts to fill this gap by examining and evaluating the existing laws and regulations; identifying the implications of such an approach in the field by thoroughly identifying the challenges faced by Indonesian SOEs in implementing the ideal stakeholder model; and providing recommendations to make the concept and application of the stakeholder model become more consistent with the theoretical and international best practice perspectives.

This article is structured as follows: It begins by briefly explaining the theoretical background of the stakeholder model. It is then followed by an explanation of the narrow legalistic stakeholder model and the implications of such an approach for both Indonesian SOEs and their legitimate stakeholders. Furthermore, the analysis focuses on a new ideal approach of the stakeholder model (the revised model) for Indonesian SOEs. The article continues with a brief investigation of the challenges faced by Indonesian SOEs in implementing the stakeholder model in the industry. Finally, in the conclusion, some resolutions are provided to overcome the weaknesses in the existing Minister of SOEs' regulations on the stakeholder model in Indonesian SOEs and to make the stakeholder model concept and application in Indonesian SOEs be more compatible with the theoretical and best practice standards.

2. Research Questions and Methodology

This research has three main research questions: First, what does the narrow legalistic stakeholder model in Indonesian SOEs look like? Second, what are implications of the narrow legalistic stakeholder model in Indonesian SOEs? Third, what are the challenges faced by Indonesian SOEs in implementing the ideal stakeholder model? This research applied a mixture a doctrinal legal research and an empirical legal research. A doctrinal legal research is a kind of research providing a systematic elucidation of a particular legal

category, which offers a rules–relationship analysis, explains difficult areas of the rules, and possibly predicts future developments (Hutchinson & Duncan, 2012). Hence, it can be stated that a doctrinal legal research is an investigation to question the validity of existing laws and regulations (*de lege lata* or the law as is or *ius constitutum*), to reveal the weaknesses of existing laws and regulations, and to propose future laws and regulations (*de lege ferenda* or *ius constituendum*). In the doctrinal legal research, primary legal documents, such as the SOE Law of 2003 and the Minister of SOEs’ Regulation Concerning the Implementation of Good Corporate Governance in SOEs, were analyzed. From these two regulations, the existing definition of the stakeholder model and the goals of Indonesian SOEs were identified and analyzed.

In order to support the doctrinal analysis, an empirical legal research was deployed. Empirical legal studies can be simply understood as the study of law from cases, courts decisions, or facts (see, for example, George, 2006; George & Guthrie, 2002; George & Yoon, 2014; Epstein & King, 2002; Nard, 1995). In this empirical legal research, one vital verdict of the Indonesian Constitutional Courts issued in 2018 and one important verdict of the Balikpapan District Court issued in 2019 were also examined to comprehend the implications of the narrow legalistic stakeholder model in Indonesian SOEs and the challenges face by Indonesian SOEs in implementing the broader moral and legal stakeholder model. These two verdicts are collected from the official website the Supreme Court of Indonesia and the Constitutional Court of Indonesia. They then analyzed descriptively and analytically based on the author’s proper and valid understanding and interpretation on the issues examined in this research.

Other secondary sources, such as international codes and/or guidelines on corporate governance, such as the 2016 United Kingdom Code, (The Dutch Corporate Governance Code Monitoring Committee, 2016), the 2017 German Code, the 2015 OECD/G20 Principles, and relevant journals were used to analyze and construct the proper ideal of the stakeholder model and identify direct and indirect legitimate stakeholders of Indonesian SOEs and recognize the challenges faced by Indonesian SOEs to implement an ideal stakeholder model. The analysis of primary and secondary data was carried out from 2021 to 2022.

3. Literature Review

Theoretically, the stakeholder theory was first proposed by Freeman (1984), who argued that those who influence and are influenced either directly or indirectly by the company’s business operations are stakeholders. For this reason, their interests and welfare should be considered by the company in making decisions and doing business operations. Freeman’s thoughts, which were later widely accepted and have been referred to as ‘the locus classicus of the modern stakeholder theory’ (Phillips, 2011), were later developed by other scholars who provided deeper theoretical and normative foundations for the concept of the stakeholder model (see, for example, Donaldson & Dunfee, 1999; Jones & Wicks, 1999; Donaldson, 1989; Freeman et al., 2010).

The impetus of the stakeholder model is the fact that the widely adopted shareholder model focuses too much on the well-being and interests of shareholders and neglects other stakeholders (Carney, 2005; Young et al., 2008; A. L. Friedman & Miles, 2006; Hill & Jones, 1992). In the shareholder model, a corporation is perceived as ‘a nexus of contracts among owners, who essentially pursue private means and run the corporation in their own self-interest without explicit obligations to society’.

Phillips et al. (2003) insisted that the stakeholder theory encourages moral and ethical values to be the center of managing companies. In line with Phillips et al. (2003), Jones and Wicks (1999) argued that the stakeholder model provides a normative legitimation that is ‘explicitly and unabashedly moral’ and helps managers and board members to run their

business in an ethical way. Similarly, Fassin (2009) asserted that the stakeholder approach has become a vital tool to transfer ethics to management practices and strategies.

Despite numerous studies that have been published on the validity of the stakeholder model (for example, see Hendry, 2001; Donaldson & Dunfee, 1995; Freeman et al., 2004; Donaldson & Preston, 1995; Smith, 2003), the stakeholder model has not been without criticism. Proponents of the shareholder theory, such as Esser and du Plessis (2007) and Anabtawi and Stout (2008), maintain that directors and managers owe duties to the company as a separate legal entity. This means that they should act in good faith and in the best interest of the company (Rissy, 2019b, 2020a, 2020b). Hansmann and Kraakman (2000) affirmed that there is a consensus among scholars, practitioners, and the judiciary that at the heart of the shareholder model is the idea that board members and managers are required to increase the interests and wellbeing of the shareholders. Sundaram and Inkpen (2004) even strongly claimed that the shareholder model is the most qualified one among all available options; thus, board members and managers should take it into account when formulating and implementing the company's mission. Even far before the emergence of the stakeholder model idea, shareholder admirers like M. Friedman (1962) strongly confirmed that the only goal of a company is to seek profit for the shareholders and the company does not need to perform corporate social responsibility activities. This idea was later supported by Ho (2010), who stated that companies that carry out corporate social responsibility will reduce company's profits, which in turn leads to the reduction the welfare of shareholders.

Regardless of its wider acceptance and implementation, the stakeholder model is still misunderstood both in its concept and applications in Indonesia. Rissy (2018, 2019a, 2021a, 2021b, 2021c) found that the concept and application of the stakeholder model has been misleadingly constructed by the Indonesian Financial Services Authority in the Indonesian banking sector. He maintains that this phenomenon occurs because the stakeholder model is still in its infancy in Indonesia, and more elaborative theoretic and practical strategies need to be conducted to mitigate this issue.

A similar situation happens in Indonesian SOEs as the Minister of SOEs' Regulation of 2011 concerning the implementation of good corporate governance in Indonesian SOEs has inadequately conceptualized the stakeholder model in the industry. This is where this study has its relevancy, which is to criticize the narrow legalistic stakeholder model in Indonesian SOEs to identify the implications of such an approach and to investigate the challenges faced by Indonesian SOEs in implementing an ideal stakeholder model.

Another relevance is that recent studies in relation to the application of stakeholder theory in SOEs in Indonesia only focus on the correlation of firm performance in state-owned enterprises in Indonesia and the application of the stakeholder theory (Sulastrri & Muizuddin, 2024). Hence, it is expected that this research can contribute to a better understanding of shifting from the narrow legalistic stakeholder model in Indonesian SOEs to the application of broader moral-based stakeholder theory.

4. Results and Discussion

4.1. *The Narrow Legalistic Stakeholder Model in Indonesian SOEs*

As previously indicated, the Minister of SOEs' Regulation of 2011 conceptualized stakeholders as parties that have a stake in SOEs, as they have a legal relationship with SOEs' (Art 1(8)). This regulation simply requires Indonesian SOEs to acknowledge that their stakeholders have a legal relationship with them. This means that stakeholders are recognized under a narrow legalistic approach. There is no further explanation on this definition. This kind of an acknowledgment is not adequate theoretically and does not

comply with the international best practices as highlighted in the latest code of corporate governance like in the Netherlands (2016) and the United Kingdom (2015).

Theoretically, as proposed by some prominent scholars in the field of stakeholder management, a party can have a stake in a company for several considerations. Freeman (1984, p. 25) defined stakeholders as “any group or individual who can affect or is affected by the achievement of the firms’ objectives”. Later, Freeman et al. (2007) proposed a new approach to the stakeholder model with the two-tiered stakeholder map. They argued that stakeholders can be categorized into two groups. The first is the inner circle of stakeholders, such as employees, suppliers, financiers, customers, and communities. These groups determine most companies’ business activities. The second is the outer ring of stakeholders, such as competitors, consumer advocate groups, the government, the media, and special interest groups.

Cornell and Shapiro (1987) argued that a party might have some entitlements to a company due to its implicit or explicit contract with the company. Implicit claims are not based on a written contract, while explicit claims are from those who have a clear written contract with the company. Donaldson and Preston (1995) suggested that individuals or a group of people are stakeholders in a company when they have an implicit or explicit contract with the company and when they have actual and potential advantages and disadvantages due to the firm’s activities. Later, Evan and Freeman (1988) supported Donaldson and Preston’s (1995) ideas by arguing that a party has a stake or claim in a company if it benefits from or is harmed by the company’s actions. In addition, Langtry clearly stated that if some party’s well-being is determined by the company’s decisions to act or not to act, then they are also stakeholders of that company.

The narrow legalistic stakeholder model stipulated in the Minister of SOE’s Regulation of 2011 also does not comply with best practice standards that are widely accepted in the latest code of governance in some countries, such as the Netherlands and Germany, and as proposed by G20/OECD principles. In the German Code (2017), the term ‘stakeholders’ is used to highlight a management board’s responsibility to consider the interests of the shareholders, its employees, and other stakeholders, with the objective of a sustainable creation of value. Whereas in the Dutch Code (2016), it is highlighted that stakeholders are those “who directly or indirectly influence—or are influenced by the achievement of the company goals”, including employees, shareholders and other lenders, suppliers, customers, the public sector, and civil society. The board of the company oversees weighing the legitimate stakeholders’ interests and ensuring the sustainability of the company and attainment of long-term value creations of all stakeholders. Meanwhile, The G20/OECD (2015) stress that stakeholders play a vital role in a company. For this reason, the board should weigh their interests when generating prosperity and jobs and take into consideration their active participation in the company. They are employees, creditors, customers, suppliers, and local communities. Therefore, it can be stated that those who have a stake in a company or stakeholders are not only those who have a legal contract with the company. Stakeholders could also be those who affect the company or are affected by the company operations.

The Minister of SOEs regulation’s approach to the stakeholder model is a narrow legalistic one as it only considers those who have a legal relationship with SOEs as the legitimate stakeholders of SOEs. However, as there is no further explanation of who can be categorized as Indonesian SOEs’ stakeholders, the author tried to construct a narrow legalistic stakeholder model of Indonesian SOEs, as depicted in Figure 1. In this narrow legalistic stakeholder model, the Indonesian SOE stakeholders are categorized into one group only, which is direct stakeholders. They are those individuals or groups that have a legal contract with Indonesian SOEs, such as employees, shareholders, creditors, bank

syndicates, the central government, and suppliers. To them alone, Indonesian SOEs and their board members have a legal responsibility to weigh their interests and well-being.

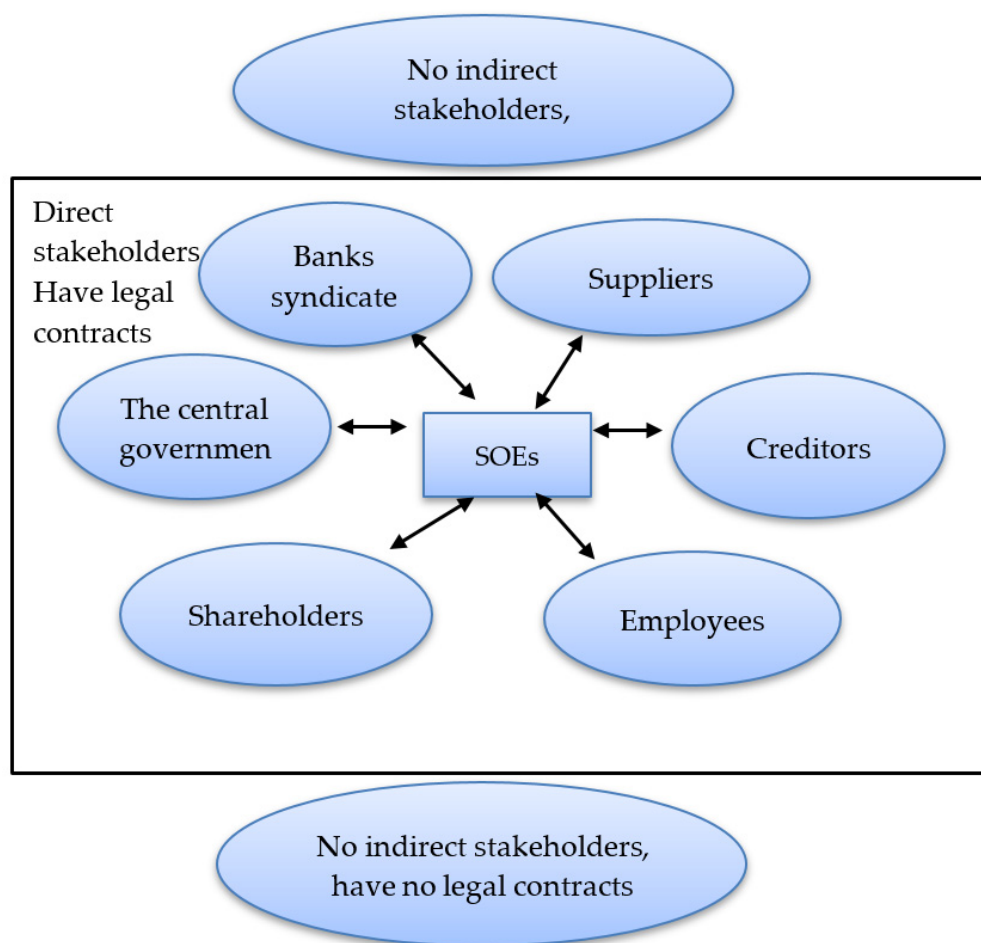


Figure 1. Indonesian SOEs' narrow legalistic stakeholder model.

Unfortunately, the narrow legalistic stakeholder model in Indonesian SOEs does not have indirect stakeholders, as they have no legal contract with Indonesian SOEs. They could be a community, non-governmental organizations, the local government, environmental entities, the mass media, and consumer advocate groups. Consequently, Indonesian SOEs and their board members do not have a legal responsibility to these groups and their interests and well-being could be neglected.

4.2. Implications of the Narrow Legalistic Stakeholder Model and the Call for the Broader Moral and Legal Stakeholder Model

The narrow legalistic stakeholder model in Indonesian SOEs might have several critical consequences both for the SOEs themselves and for their indirect stakeholders. For the SOEs, especially the board members, they will not consider the interests of indirect stakeholders who do not have a legal contract with them. The interests of indirect stakeholders, such as local communities, environmental entities, job creation for local communities, product safety advocated by consumer groups and the mass media, and so on, might be neglected. Meanwhile, for indirect stakeholders, the business operations of Indonesian SOEs might be opposed by these forgotten individuals or groups (indirect stakeholders).

In several cases that were widely reported by the Indonesia mass media and disclosed by a number of environmental activists, there were some serious allegations towards Indonesian SOEs, especially state-owned banks, to finance other SOEs and private com-

panies engaging in the exploration and exploitation of natural resources that endanger environmental sustainability. The environmental sectors affected are generally forests due to destructive gold and coal-mining activities, rivers polluted due to industrial waste and oil spills, and forest clearing for the benefit of oil palm plantations, which results in the destruction of biodiversity and forests on a large scale (Katadata.co.id, 2020; Indonesian Constitutional Court, 2018). The Indonesian Forum for the Environment (Walhi, 2018) reported that several Indonesian SOEs as well as multinational and national private companies were behind the criminalization efforts carried out by security officers against 157 local community members across Indonesia that opposed some of their business operations. In 2019, there were 555 cases related to land conflicts that were reported to the Presidential Office Staff involving several SOEs as well as multinational and national private companies (Walhi, 2018).

The protests towards the Indonesian SOEs' business operations, especially the Indonesian SOEs which exploit oil and gas, also come from the local government forum, a forum that consists of heads of local governments where their production is carried out in their regions because they do not get involved in the management, do not have access to information related to the oil and gas produced, and do not receive any profit sharing (Akurasi.id, 2019; Bisnis.com, 2018; Jawapos.com, 2018; Blara.kab.or.id, 2019).

A few cases and issues described above at least show that when indirect legitimate stakeholders, such as the local government, communities, and environmental entities which do not have a legal written contract with Indonesian SOEs, are not considered as stakeholders, their interests and well-being are also ignored. But this is the implication of the narrow legalistic stakeholder model in Indonesian SOEs. As such, to avoid these disadvantages, the author proposes a revision to the narrow legalistic stakeholder model in Indonesian SOEs to a broader moral and legal stakeholder model in Indonesian SOEs as seen in Figure 2.

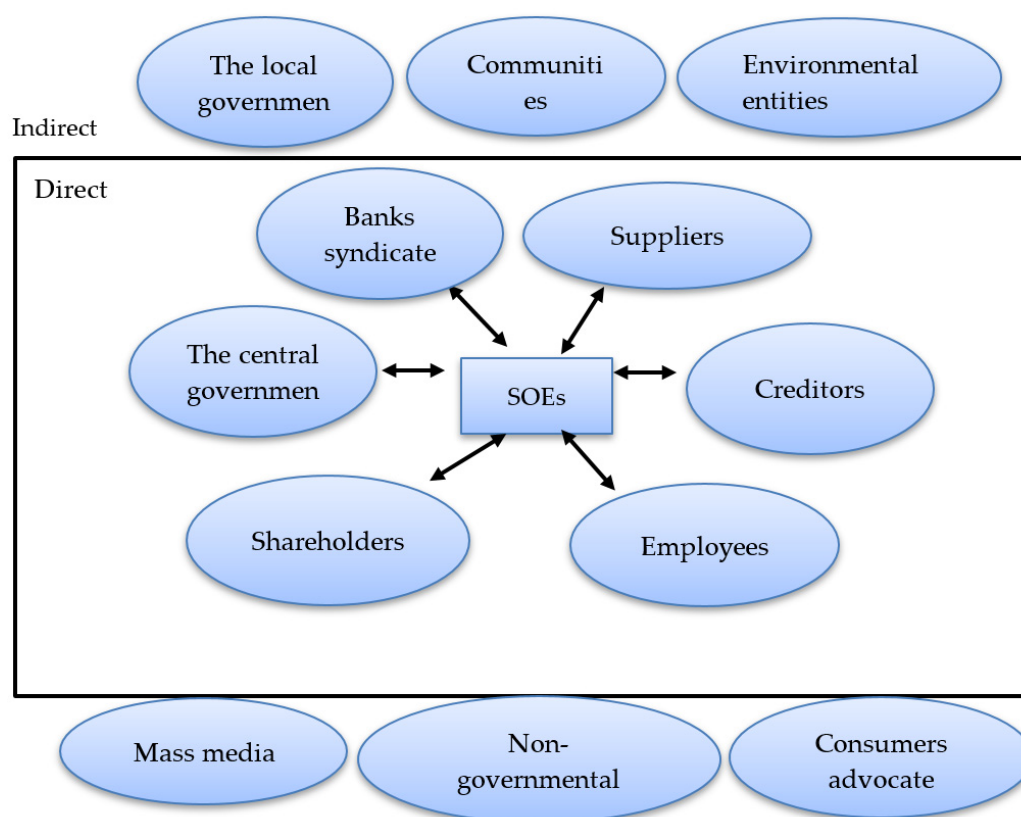


Figure 2. Indonesian SOEs' broader moral and legal stakeholder model.

Figure 2 illustrates that Indonesian SOEs have two sorts of legitimate stakeholders: direct and indirect stakeholders. Direct stakeholders are those who have legal contracts with Indonesian SOEs. They are employees, shareholders, the central government, suppliers, creditors, and bank syndicates. These direct stakeholders have a direct strategic role in determining the continuation of the business operations of Indonesian SOEs. Without them, the business operations of the Indonesian SOEs could stop. To them, Indonesian SOEs and their board members should have moral and legal responsibilities to weigh their interests and well-being (Phillips, 2003) This is the true nature of the ideal stakeholder model.

Meanwhile, indirect stakeholders are those who do not have a legal contract with Indonesian SOEs. They are the local government, communities, the mass media, non-governmental organizations, environmental entities, and consumer advocate groups. Indirect stakeholders have implicit and explicit vital roles that determine the sustainability of the business operations of Indonesian SOEs. Without them, the business operations of Indonesian SOEs could be disrupted. To them, the Indonesian SOEs and their board members should also have moral and legal responsibilities to align their interests and well-being. This is also the true essence of the stakeholder model.

Therefore, because of the broader moral and legal stakeholder model, the concept of stakeholders in Indonesian SOEs also needs to be corrected. Stakeholders of Indonesian SOEs should be defined as those individuals or groups who have a legal contract with Indonesian SOEs and those who have no legal contract with Indonesian SOEs where their interests and well-being need to be weighed in the SOEs' decisions and business operations, as their existence and participation will affect the attainment of the industry's goals and be affected by the Indonesian SOEs' business operations.

4.3. Challenges Faced by Indonesian SOEs in Implementing the Broader Moral and Legal Stakeholder Model

There are three main challenges faced by Indonesian SOEs to implement the broader moral and legal stakeholder model identified by the author. They are the short-term profit-driven orientation, the primacy of the shareholder culture, and the restrictive legal and ethical obligations from the SOEs' boards to implement the new revised and broader moral and legal stakeholder model.

4.3.1. Short-Term Profit-Driven Orientation

The main goal of Indonesian SOEs is the pursuit of profit (Art 2 (b) of the SOEs' Law of 2003). So far, the predominant understanding is that SOEs are government instruments to generate profit for the government. To achieve this goal, SOEs are an extension of the government to manage Indonesia's financial and natural resources. As a result, SOEs in Indonesia are very powerful. Despite this, there are other objectives of SOEs, such as bringing prosperity to the people of Indonesia (Art 2 (c) of the SOEs' Law of 2003). But this goal is more of a slogan or rather just a series of words without meaning or just merely a law in books because, in practice (Pound, 1910), all profits earned by SOEs are deposited with the government according to the mandate in Art 2 (a) of the SOEs' Law of 2003.

Each SOE has been given a target by the Minister of SOEs to pay dividends to the government. In 2020, for example, as stipulated in President Regulation Number 72 of 2020 Concerning the 2020 State Budget, the total dividends that need to be paid by Indonesian SOEs to the government reached Rupiah 65 trillion (approximately USD4.5 billion). To achieve this target, SOEs do everything they deem necessary to meet the target, including not considering the interests of their stakeholders in a broad sense, including their indirect stakeholders. The case of the PERTAMINA's (Indonesia's biggest state-owned oil company) oil spill in Balikpapan bay in 2018 is an example of PERTAMINA's carelessness in considering the interests and wellbeing of its indirect stakeholders, namely the environ-

mental entities, the local government, and communities regarding the issue of water and mangrove conservation and the safety of local communities. In this case, 300 hectares of mangrove forests were threatened with death, the Balikpapan sea, which is a source of fish for local communities was polluted, the spill killed five people, and the health status of the surrounding communities declined (Balikpapan District Court, 2019).

When adjudicating this case, the District Court of Balikpapan decided, among other things, to acknowledge the negligence of PERTAMINA, the Ministry of the Environment and Forestry, and the Ministry of Transportation in preventing the spill. The problem is that there was no regulation about an early warning information system from PERTAMINA, the Ministry of Environment and Forestry, and the Ministry of Transportation regarding an early detection system for oil spills and oil spill emergency management at sea. In this case, it is clear that PERTAMINA failed in carefully considering the interests of its indirect stakeholders that did not have a legal contract with it, such as the local communities and the environment (Balikpapan District Court, 2019).

The pursuit of profit per se of Indonesian SOEs has been criticized by some scholars in Indonesia. The phrase ‘the pursuit of profit’ has been brought before the Indonesian Constitutional Court to be judicially reviewed. Saragih stated that the phrase ‘the pursuit of profit’ has triggered SOEs and their board members to act as profit search engines. As a result, they tend to ignore the externalities of the impacts of their business operations to the communities and in terms of the social, economic, and environmental aspects (Indonesian Constitutional Court, 2018, p. 44). Soetaprawiro criticized the phrase ‘the pursuit of profit’ by stating that the phrase is incomplete and should be understood as the pursuit of profit for the sake of Indonesian people’s prosperity. This is because any effort to manage, explore, and exploit the state assets, including natural resources, should be in line with Art 33 (3) of the 1945 Constitution (Indonesian Constitutional Court, 2018, p. 58). Trihatmoko even critically argued that the phrase ‘the pursuit of profit’ has departed from Indonesian Welfare State Economic Constitution paradigm and supports the neo-liberal and capitalistic economic paradigm.

When examining this case, even the Indonesian Constitutional Court rejected the petition to delete the phrase ‘the pursuit of profit’ as ruled in the SOEs Law of 2003; the Constitutional Court clearly considers that the goal of Indonesian SOEs, that is, the pursuit of profit, must be understood as an integral part of the other goals of Indonesian SOEs, such as to bring prosperity for Indonesian people. This means that, in the author’s opinion, Indonesian SOEs should weigh the interests and well-being of all their direct and indirect stakeholders in making their decisions and doing business operations.

Furthermore, it is argued that the pursuit of profit as the goal of Indonesian SOEs per se is still heavily dependent on the notion of shareholder model primacy, and at the same time, it is contradicted with the notion of the stakeholder model as narrowly adopted in the Minister of SOEs’ Regulation of 2001. Theoretically, Smith (2003) clearly stated that the shareholder theory is ‘geared toward short-term profit maximization at the expense of the long-run’. To escape from this trap, Freeman et al. (2004) maintained that when dealing with the goals of the company, board members are encouraged to articulate a shared sense of the value that they create to all their legitimate stakeholders. Freeman et al. (2010) insisted that board members should articulate the way they do business, in particular, the type of relationship they want to build with their stakeholders to achieve their goals. They further maintained that the premium goal of the stakeholder theory is that capitalism is designed for creating value for all stakeholders. Moreover, Donaldson and Preston (1995) asserted that in the stakeholder model, the ultimate mission of companies is that the validity of diverse stakeholder interests should be considered profoundly by the board members,

and they also should align the interests of the stakeholders in a mutually supportive framework, as that is a moral prerequisite for the management to effectively function.

In addition, the short-term profit-driven concept applied in Indonesian SOEs is no longer valid in an era where companies are generally in favor of prioritizing long-term value creation and sustainability of the company. These kinds of goals are promoted in the latest code of corporate governance such as in the United Kingdom (UK) and the Netherlands. In these two countries, it is precisely formulated that the ultimate mission of a company is to deliver long-term success or to achieve long-term value creation for the company. In the UK Code of 2016, it is stated that ‘the purpose of corporate governance is to facilitate effective, entrepreneurial, and prudent management that can deliver the long-term success of the company’. It is also stipulated that ‘every company should be headed by an effective board which is collectively responsible for the long-term success of the company’.

Similar with the UK Code of 2016, the Dutch Code of 2016 definitively underlines that long-term value creation is the major goal of a company. The boards are put in place to warrant that this goal is achieved. Principle 1.1 of the Dutch Code of 2016 similarly states that ‘the management board is responsible for the continuity of the company and its affiliated enterprise. The management board focuses on long-term value creation for the company and its affiliated enterprise, . . . The supervisory board monitors the management board in this’.

It is worth remembering that in terms of governance structure, the UK applies one-tier governance, while the Netherlands, like Indonesia, implements two-tier governance. Even though the structure of the two tiers is different, in the context of the company’s long-term goals, they both have destinies, namely prioritizing long-term value creation and sustainability of the company by considering all parties that are impacted, directly or indirectly, by a company’s activities.

From all the above elucidation, it is recommended that the Minister of SOEs should consider reformulating the SOEs’ goal from only the pursuit of profit to achieve long-term value creation or to attain the long-term success of the company. This means that there is a need in Indonesian SOEs to shift from the short-term pursuit of being profit-driven to the long-term value creation or success of the company.

4.3.2. Primacy of the Shareholder Culture

The second biggest challenge for Indonesian SOEs in applying the broader moral and legal stakeholder model is the domination of shareholder primacy or agency culture in Indonesian SOEs. As applied to all Indonesian SOEs, the central government is the sole or the controlling shareholder of the industry. This means that the Indonesian government has the power to fully control the dynamic and development of SOEs, to appoint and dismiss the board members (Art 15 of the SOEs Law of 2003), and at the same time, the SOEs and their boards should serve the interests of the government. However, as indicated in the Introduction Section, it has been a fact that Indonesian SOEs have been long managed under a shallow strong shareholder primacy that significantly contributed to the financial crisis and crony capitalism in 1999, and despite the wider adoption of the stakeholder model in many sectors, the shareholder primacy culture still exists until now.

This can be understood, as the government, as the sole or the controlling shareholder, wants to secure their interests first. This is in line with Boatright’s (2004) speculation that shareholders are special in the history of the company. Sundaram and Inkpen (2004) even argued that a company should focus solely on maximizing shareholders’ value and well-being. When the government exists and significantly influences as the sole shareholder or majority shareholder of Indonesian SOEs, the choice and willingness to deploy the

broader moral and legal stakeholder model in the Indonesian SOEs would create a huge responsibility for the board to overcome such a dominant culture.

For this reason, the author argues that there is a need to shift from the shareholder pre-eminence and the narrow legalistic stakeholder model to the broader moral and legal stakeholder model in Indonesian SOEs. If this is the scenario, theoretically, it might lead to the creation of greater total value for all stakeholders. But again, even if such a shift is made, in practice, the tension between non-shareholder stakeholders, shareholders (the government), and the board's managerial discretion would be a real problem. Yet, the SOEs' board members and the government as the sole or controlling shareholder should apply the new revised and broader moral and legal stakeholder model consistently and commit themselves to shift from a shareholder primacy culture to a new ideal stakeholder culture.

4.3.3. Restrictive Legal and Ethical Obligation from SOEs' Boards to Implement the Broader Moral and Legal Stakeholder Model

The third challenge identified by the author is the restrictive legal and moral obligation from SOEs' boards to implement the new revised stakeholder model. By regulation, it is obvious that Indonesian SOE board members have no legal obligation to weigh the interests and well-being of those individuals or groups (indirect stakeholders) that have no legal contract with the SOEs. By ethics, Indonesian SOE board members also have no ethics or moral obligation to consider the interests of those who have no legal contract (indirect stakeholders). On one hand, this indicates a clear distinction between ethics and business in Indonesian SOEs. On the other hand, the distinction between business and ethics has been opposed widely by some prominent scholars when criticizing the shareholder primacy.

In the debate on the moral standing of the shareholder primacy, in the scandal of Enron and WorldCom, for example, the shareholder primacy is criticized as too self-centric since it ignores ethics and moral issues. Hendry (2001) called this situation as a problem of 'moral egoism', a situation where the principal's natural ego heavily rules professional managers so that they act to serve only the principal's own well-being. Other stakeholders, as a result, can be subject to opportunistic expropriation by the firm's professional managers and its main shareholders, since they are obliged only to align to the firm's shareholders' interests (Hansmann & Kraakman, 2000).

For this reason, Indonesian SOE board members and the government as the sole or controlling shareholder should commit themselves to the ideal of the stakeholder model to not separate business and ethics. Phillips et al. (2003) and Freeman et al. (2010) argued that the stakeholder model starts with the thought that moral and ethical values are an integral part of doing business. Hence, the stakeholder model rejects the separation of business and ethics (the separation thesis) and encourages 'the integration thesis', where almost every business decision has some ethical substance and there is a need to establish 'the responsibility principle' where people or companies are given an opportunity to be responsible for the impacts of their actions to others.

Under this understanding, the stakeholder model tries to mitigate the shareholder model's moral deficiency. Phillips et al. (2003) confidently insisted that the 'stakeholder theory is distinctive because it addresses morals and values explicitly as a central feature of managing organizations'. Jones and Wicks (1999) also contended that the stakeholder model has a normative legitimation that is 'explicitly and unabashedly moral' and helps professional managers do their businesses in an ethical way. Furthermore, Fassin (2009) asserted that the stakeholder approach has become a vital tool to transfer ethics to management practices and strategies.

In addition, to commit themselves to the broader moral and legal stakeholder model, it is critical for Indonesian SOEs, their shareholders, and board members to have what Kochan

and Rubinstein (2000) called ‘knowledge assets’. These knowledge assets deal with the ability to understand the concept of the stakeholder model and its application. This would mean that Indonesian SOEs, their shareholders, and board members would be strongly encouraged to possess vital technical skills and knowledge that enable them to individually or collectively implement and supervise the commitment to the stakeholder model.

To this point, again, Indonesian SOEs, their board members, and the government, as the sole or controlling shareholders, should be more open and consistent to the broader moral and legal stakeholder model, that is, to integrate their core business practices with ethical values. This can be carried out by not only weighing the interests and well-being of the direct stakeholders but also aligning those of indirect stakeholders. Otherwise, the industry will continue to be trapped in a narrow legalistic approach to the stakeholder model or even continue to be heavily influenced by the egoist primacy of the shareholder culture.

5. Conclusions

The stakeholder model has been widely accepted over the last thirty years. Despite this, its adoption in the Minister of SOEs’ Regulation of 2011 was inappropriate. There are three main findings of this research in relation to the adoption stakeholder theory. First, the adoption put the stakeholder model under the narrow legalistic approach. In such an approach, Indonesian SOEs and their board members should only weigh the interests and well-being of those individuals and groups or stakeholders that have a legal contract with Indonesian SOEs. They are employees, shareholders, creditors, bank syndicates, the central government, and suppliers.

Second, in terms of the implication the adoption of the narrow legalistic stakeholder model in Indonesian SOEs, the research reveals that those individuals and groups, such as the local government, communities, and environmental groups which do not have a legal contract with Indonesian SOEs, are not considered as stakeholders. Consequently, their interests and well-being have been neglected in Indonesian SOEs’ decisions and business operations. Hence, it is suggested that Indonesian SOEs and their board members should adopt and apply a new revised model, the broader moral and legal stakeholder model.

Third, considering challenges that might be faced by Indonesian SOEs in applying the new revised and broader moral and legal stakeholder model, this study also confirmed three main obstacles. They are the short-term profit-driven orientation, the strong culture of shareholder primacy, and the restriction of legal and moral obligations of the industry. To resolve these problems, it is suggested that Indonesian SOEs should focus on attaining long-term value creation or sustainability, apply a more inclusive stakeholder model, and utilize a more sensible unification thesis, which is the integration of business and ethics in their decisions and business operations.

Under the stakeholder theory perspective, this research adds to the existing literature regarding the weaknesses of adopting the narrow legalistic stakeholder model in Indonesian SOEs and enriches understanding of the importance of SOEs directors in combining the broader moral and legal stakeholder model to obtain more proportional consideration when determining the interests of all parties categorized as stakeholders.

The implication of this research is that the Indonesian Minister of SOEs should revise its regulations on the implementation of stakeholder models in Indonesian SOEs. In addition, the directors of SOEs should also alter their policy from only considering those who have a legal contract with the company as stakeholders to all parties affected, directly or indirectly, by the company’s operations as stakeholders.

It is expected that local communities and all other stakeholders will benefit from the new, revised model’s implementation, as their interest will be considered by SOEs directors, directly or indirectly, in their decisions.

6. Limitations and Future Research

This study applied a doctrinal legal research methodology, which predominantly relied on the understanding and interpretations of the author of the legal sources examined. However, when the understanding and interpretations of this topic are based on the same succinct doctrinal legal research and theoretical background, the results and discussions might be similar. In addition, to support the doctrinal analysis, an empirical legal research was also carried out. In the future, research should focus on the application of aligning legitimate stakeholders of Indonesian SOEs.

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Article

Mergers and Acquisitions' Moderating Effect on the Relationship Between Credit Risk and Bank Value: A Quantile Regression Approach

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Abstract: This research explores the relationship between credit risk and bank value within the framework of horizontal mergers and acquisitions (M&A), employing a quantile regression approach to analyze how horizontal M&A activities moderate this relationship across 110 operational Bank Holding Companies (BHCs) over 23 years. This paper stands out from previous studies by extending the scope beyond linear approaches and using the Quantiles via Moments estimator to address potential endogeneity concerns. The results demonstrate a significant negative link between credit risk and bank value, which decreases in magnitude as moving higher in the value distribution. Conversely, there is a consistent positive connection between M&A activities and bank value that is stable across different quantiles of value. Mergers and acquisitions worsen the negative impact of credit risk on bank value, affecting banks with both low and high values similarly. The findings provide useful information for investors, practitioners, and policymakers in the banking industry. Investors may use credit risk and value proposition assessments to make well-informed investment decisions, or to construct well-diversified portfolios, and identify appropriate institutions for mergers and acquisitions to enhance value. It is recommended that practitioners prioritize efficient credit risk management, especially before engaging in M&A activities and aligning them with the bank's value proposition. Policymakers should develop guidelines to regulate M&A transactions, using established dynamic credit risk standards that correspond to banks' value propositions, to promote financial stability and drive industry expansion.

Keywords: bank value; credit risk; M&A; moderating effect; quantile regression

1. Introduction

Since the global financial crisis (GFC) of 2007–2008, the credit risk topic has become a greater concern in the financial industry. The high-financial-leverage nature of banks makes credit risk management a top priority. Unlike other institutions, banks adapt traditional asset and liabilities management into asset default and liabilities default management. Liquidity monitoring focuses on preventing liquidity defaults. Profitability is a key consideration, assessed primarily from the perspective of economic default (Chen & Kuei, 2024). The consequences of the GFC on the global economy were initially reflected in the collapse of the value of institutions operating in the banking sector, demonstrating the importance of understanding the factors that influence banks' value, which is commonly linked to stock price (Amimakmur et al., 2024).

Worldwide, the phenomenon of M&A in the banking sector has constantly increased. While in the year 1985 there were only 247 deals, this number peaked in the year 2018, reaching over 2000 deals (Statista, 2024). M&A benefit banks by raising capital, expanding, achieving a competitive advantage, enhancing financial operating performance and bringing financial stability (Chakraborty & Das, 2024).

Montgomery and Takahashi (2014) find that M&A lead to an increase in both shareholders' wealth and the credit risk of banks involved in such transactions. Hassan and Giouvris (2020) observe that local bank-to-bank M&A create shareholder wealth, with local M&A associated with a reduction in credit risk, while cross-border M&A are linked to an increase in risk. Both papers rely on traditional conditional mean analysis techniques, including multivariate regression, robust regression, maximum likelihood regression and weighted least squares regression. However, Wang et al. (2024) clarify that these methods rely on assumptions of normality and homoscedasticity, which are often not met in real-world financial data. Given the high volatility and non-normal distribution of such data, these methods may be inadequate for estimation.

An alternative approach, quantile regression, offers more robust estimates and provides a comprehensive analysis of business performance changes in response to specific events. In particular, Pop and Pop (2024) observe that markets price risk differently for banks in the upper locations of the spread distribution, where market discipline is tougher for riskier banks. Similarly, Fich et al. (2018) find that the characteristics related to the acquiring banks have varying effects on the distribution of abnormal returns. To understand complex predictor–response relationships, Cunningham et al. (2020) consider quantile regression an ideal analytical tool, as it captures variations in predictor effects across different response quantiles.

While the traditional conditional mean models can address the question of “how horizontal M&A affects the relationship between credit risk and bank value”, they cannot answer an equally important question of “how horizontal M&A moderates this relationship across different quantiles of the bank value distribution”.

Therefore, this paper investigates the moderating effect of horizontal M&A on the relationship between credit risk and bank value within a quantile-based framework.

The current literature provides explanations about the relationship of credit risk with value in the context of M&A within banking industry. Our paper offers a deeper theoretical understanding of this relationship by capturing the heterogeneity in the predictor–response relationship across the distribution of response, providing a novel contribution to the theoretical literature. Empirically, our novel results cannot be captured using standard conditional mean estimations. We introduce quantile regression to uncover how lower-valued banks and higher-valued banks exhibit different sensitivities to credit risk in M&A activities, effectively addressing challenges related to violations of normality and homoscedasticity in the financial data. Practically, our novel findings guide investors in identifying rewarding investment opportunities, assist bank managers in balancing risk and value creation during M&A, and inform policymakers about regulating credit risk exposure in M&A activities within the banking sector.

The results of this paper reveal that credit risk has a significant negative effect on bank value across the entire distribution, with the magnitude of this effect decreasing from lower to upper locations. This indicates that lower-valued banks are more vulnerable to a steeper decline in value as a result of credit risk, compared to higher-valued banks. Horizontal M&A exhibit a stable and significant positive effect on bank value across the entire distribution, suggesting that horizontal M&A consistently enhance bank value, regardless of the bank's valuation. However, the moderating effect of horizontal M&A significantly magnifies the negative impact of credit risk on bank value across the entire value distribution, but

without statistically significant differences observed from lower to upper locations of the distribution. This implies that horizontal M&A amplify the adverse effect of credit risk on bank value uniformly, across banks, regardless of their valuation, assuming other factors remain constant.

Our results encourage investors to invest in banks that intend to merge and acquire, as such activities increase their wealth. However, simultaneously, they should carefully consider the credit risk profile of these banks because credit risk plays a significant counterfactor to value creation, especially for low-valued banks. We advise investors to utilize recent machine learning techniques, such as Decision Trees, to classify and categorize these investment opportunities based on credit risk and bank value. This will exclude investing in banks that are willing to undergo M&A with other banks when they are low-valued and experience high credit risk, and will prioritize those that are high-valued and experience low credit risk, as these represent the best investment opportunities. Additionally, for investors who hold a portfolio of bank stocks, we advise them to incorporate a fundamental-based diversification strategy, where they overweight banks actively involved in horizontal M&A and underweight low-valued, high-credit risk banks, as these are more vulnerable to significant declines in value. This enables investors to maximize their portfolio value while minimizing exposure to the adverse effects of credit risk and M&A activities.

For practitioners, the paper's findings advise boards of directors in the banking sector to consider horizontal M&A as a growth strategy, as this enhances value across the entire banking sector. However, the findings emphasize the importance of implementing a tailored risk management strategy for lower-valued banks during M&A processes to minimize the adverse effects of credit risk. This approach ensures that M&A activities leverage the positive effects to the interest of shareholders. Additionally, the findings suggest that a board of directors utilize a credit risk–bank value monitoring tool that tracks both credit risk exposure and value simultaneously. This tool should adjust credit risk exposure based on the bank's value, tightening exposure when value is low and loosening it when value is high, thereby balancing risk and reward more effectively.

Policymakers can benefit from our results by establishing a supportive framework that encourages healthy M&A activities in the banking sector, ensuring these activities contribute to growth while maintaining financial stability. We also suggest developing regulatory frameworks that address the impact of credit risk exposure on the banking sector, recognizing the increased vulnerability of lower-valued banks to greater declines in value due to credit risk; a vulnerability that becomes even more pronounced during M&A transactions. Approvals for M&A should be conditioned on banks demonstrating a low credit risk profile and/or strong valuation. Regulators should establish a dynamic capital buffer that is calibrated to credit risk exposure and bank value parameters, along with introducing event-specific capital buffers during M&A activities to safeguard against foreseen and unforeseen credit risks. Additionally, policymakers can establish a monitoring mechanism to track credit risk exposure and bank value simultaneously, ensuring that banks adhere to strict credit risk policies when their value fall below specified levels.

2. Related Literature and Hypotheses Development

2.1. Credit Risk Exposure and Banking Valuation

Takahashi and Vasconcelos (2024) demonstrate the impact of credit risk on bank profitability, clarifying that the losses resulting from credit defaults reduce the capital available for investments and the issuance of new loans. Conversely, Cobbinah et al. (2024) argue that credit risk and bank performance are positively related. Charging high interest rates increases the credit defaults, but it also generates higher interest margins, thereby enhancing bank performance.

Profitability and credit risk have a significant effect on bank value. When a bank earns strong profits and achieves revenue growth, it sends positive signals to financial markets about its expansion capability and solid base. On the other hand, when bank management does not implement efficient risk management strategies to mitigate prospective losses, the confidence of shareholders and investors in the bank shakes, leading to a collapse in value (Amimakmur et al., 2024). Despite the negative relationship between credit risk and bank value, there exists a circumstance that can transform this relationship into a positive one. This occurs when market participants view the increase in credit risk indicators, such as net charge-offs or loan loss provisions, as signals of extraordinarily expected future earnings (Calomiris & Nissim, 2014).

Ryu and Yu (2021) find that the issuance of subordinated debt decreases bank profitability in a non-linear relationship. Le and Nguyen (2020) observe that the negative effect of credit risk on bank profitability differs across banks. The more profitable a bank becomes, the more it becomes sensitive to credit risk. However, extremely profitable banks show an anomaly as they are the least sensitive institutions to credit risk. Beyond this anomaly, Li's (2010) findings reveal a positive risk–return relationship for more profitable banks, while it remains negative for profitless banks. These results can be explained by the intuition of Jensen and Meckling (1976), which suggests that highly profitable banks have lower risk-taking incentives. Alongside profitability, Mamatzakis (2015) identifies that the relationship between credit risk and efficiency varies across quantiles. Banks incurring high expenses relative to income in upper quantiles are more exposed to the negative impacts of loan loss provisions and non-performing loans compared to those more efficient banks in lower quantiles.

Koutmos (2019) discovers that the stock returns of banks and the value premium of the Fama–French Five-Factor (FF5) model are negatively related to credit default swap spread changes across quantiles. These negative effects are stronger during periods of both low and high credit risk, compared to periods of moderate credit risk. Jareño et al. (2020) conclude that the stock returns of financial institutions are sensitive to changes in the risk factors of the FF5 model at extreme quantiles. Turning to the dynamics of risk and value, Jiang and Zhang (2017) observe that the relationship between franchise value and bank risk-taking is heterogeneous across quantiles: banks in the upper quantiles of franchise value tend to be more risk-seeking because valuable banks have more ability to obtain additional funds, making them take risks on a larger scale.

H₁. *The effect of credit risk on bank value varies significantly across quantiles of bank value.*

2.2. Mergers and Acquisitions and Banking Valuation

Banks utilize M&A as a strategic tool to boost their capital and grow their businesses through themes of enhancing financial and operating performance (Chakraborty & Das, 2024). These improvements resulting from M&A activities in the banking industry create abnormal returns for shareholders (Krishnan & Yakimenko, 2022). Even during periods of policy uncertainty, merged banks create shareholder wealth because uncertainty enhances synergy-driven motives (Kiosses et al., 2025). However, the deviation from pursuing synergy from M&A activities destroys bank value, particularly when the purpose of engaging in such transactions stems from pre-protectionism against competitors (Hankir et al., 2011). Managers are who craft value-creating acquisitions, and their managerial biases and skewed managerial incentives can lead to a failure in realizing value from M&A activities (Sudarsanam, 2012).

The ability to linearly predict the success or failure of M&A is limited due to the complex nature of the relationship between explanatory variables and the outcomes of M&A (Lee et al., 2020). The growth opportunities for an institution post-M&A follow a

non-linear pattern, specifically in the relationship with institution size (Park & Jang, 2011). There are unobserved factors that explain the variation in acquirer returns as much as the observed firm and deal characteristics combined (Golubov et al., 2015).

Alexandridis et al. (2017) highlight the importance of considering the size of acquiring institutions in understanding the dynamics of shareholder wealth creation in M&A activities, noting that for the best deals that enhance shareholder wealth (upper quantile), the size of the acquiring institution lessens the benefits brought from these deals. Bozos et al. (2013) observe that investors have a fear of large M&A deals between banks because these deals are highly susceptible to ‘black swan’ events, which leads investors to sell these stocks, putting downward pressure on stock prices. Alternatively, as DeYoung et al. (2009) suggest, the motive behind large banking M&A may not be the maximization of shareholder wealth but rather managerial ambitions to expand their personal empire or pursue growth through acquisition to attain a “too-big-to-fail” status. Fich et al. (2018) reveal that the effect of M&A activities on creating shareholder wealth differs across various quantiles of abnormal returns. Initially, they summarize findings from the existing literature that the bottom quantiles of abnormal losses are associated with large bidders or those exhibiting growth stocks. Furthermore, their findings contribute a new insight: the upper quantiles of abnormal returns can be associated with large bidders or those exhibiting growth stocks, particularly when these bidders target institutions that are relatively smaller in size. Souza and Gartner (2019) observe that at the upper quantiles of abnormal returns resulting from bank M&A, profitability plays a pivotal role in creating this wealth.

H₂. *The effect of horizontal mergers and acquisitions on bank value varies significantly across quantiles of bank value.*

2.3. Moderating Effect of Mergers and Acquisitions

Despite the implications of diversification in the risk–return relationship according to the portfolio theory of Markowitz (1952), and considering the co-insurance effect introduced by Lewellen (1971), which mitigates the default risk of a consolidated institution through the imperfect correlation of pre-M&A earnings, Jou et al. (2024) observe that, on average, banks become less resilient after engaging in M&A activities. The probability of default and losses during financial instability increases. Indeed, diversification reduces the probability of default. However, in the case of M&A, not all diversification enhance resiliency, and excessive diversification increases the probability of default. A greater distance and more dissimilar portfolios lead to a reduction in resiliency. Additionally, geographic diversification does not have a significant impact on resiliency. Wang (2024) observes that M&A between banks develop homogenized internal structures, thereby eliminating the potential benefits of diversification. Additionally, the researcher finds that M&A directly increase banks’ insolvency risk, and also indirectly through their interaction with diversification, because they adversely change the full picture of the risk-taking behavior of consolidated banks. Knapp and Gart (2014) explore the relationship between diversification and risk-taking behavior. They acknowledge the benefits of diversification in decreasing risk in bank M&A; however, these benefits allow banks to invest in riskier loan portfolios to generate more profits and increase stock prices, eventually neutralizing the initial risk reduction.

Strong banks show increased competitive power after M&A more than weaker banks (Arbolino et al., 2024). The concentration of banking services into fewer banks due to M&A permits banks to charge higher rates on their banking services (Kobayashi & Bremer, 2022). After M&A, banks reduce their credit supply, causing an increase in borrowing costs (Na & Shimizu, 2024). While the hike in charged interest rates increases the expected returns on loans, it concurrently raises the variability of those returns (Beck et al., 2007). Despite the

negative effects of M&A activities, they lead to extensive organizational changes that alter the nature of bank lending, such as replacing lenient previous management with a new, more restrictive one. Additionally, M&A can result in changes in information asymmetry and information-processing efficiency in banking operations. These activities shift the bank's monitoring style and lead to the adoption of higher disclosure standards, which together encourage borrowers to adopt more transparent practices and voluntary disclosure (Chen et al., 2024).

Usually, following M&A activities, banks report profits that fall below the industry average. As a result, financial markets tend to respond negatively to the announcements of M&A between banks. This decline in profits is frequently attributed to mistakes in managerial decisions made during the M&A process. Such errors lead to significant problems in credit quality, which pose the primary cause for profits reduction (Knapp et al., 2005). While the chief executive officer of the acquiring bank—with high power, a dual role as board chair, significant ownership, high pay and extensive experience—reduces the bank risk profile, their prestige power increases it (Sghaier & Hamza, 2024). The credit losses experienced post M&A prevent banks from generating profits, ultimately stopping the value-creation process that is expected to result from M&A (Shirasu, 2018). Banks with a high portion of non-performing loan engage in M&A to avoid collapse (Kaur & Bala, 2024). Acquiring distressed banks negatively impacts the performance of the acquiring bank (Dinger et al., 2024).

The most interest from income and credit loss predictions is found in quantiles analysis, as it provides strong estimates (Somers & Whittaker, 2007). Explaining the link between M&A outcomes and their predictors is too complex for linear statistical approaches (Lee et al., 2020). Post bank consolidation, financial stability behaves in a non-linear fashion, supporting an inverted-U-shape relationship (Ishu & Mallik, 2024). Bank size by itself can alter the risk profile during M&A, as large banks believe that they are too big to fail; thus, they engage in riskier lending more than smaller banks. When these banks grow even larger due to M&A activities, they engage in risky lending activities even more heavily (Jou et al., 2024).

H3. *The moderating effect of horizontal mergers and acquisitions on the credit risk–bank value relationship varies significantly across quantiles of bank value.*

3. Methodology

3.1. Data and Sample Description

The data for this paper were compiled on an annual basis and were obtained from several sources. M&A data, and the FR Y-9C reports, which offer consolidated financial statements, were both retrieved from the Federal Financial Institutions Examination Council (FFIEC). Market-related data were acquired from the YCharts platform. Macroeconomic data were obtained from the International Monetary Fund (IMF).

The data focus on BHCs within the U.S. banking industry. This focus is justified by the fact that the U.S. banking sector has witnessed over 10,000 M&A transactions since 1980 (Adams, 2012), making it an ideal field for M&A research. Additionally, approximately 80% of U.S. banks are part of a BHC structure, meaning that BHCs represent the banking industry in U.S. environment (Fed Partnership, 2024).

Our sample includes 110 BHCs, spanning the period from 2000 to 2022, covering 23 years. This combination of cross-sectional (BHCs) and time span (Years) data forms a panel dataset, resulting in 2530 observations.

At the end of 2000, there were 5845 active U.S. BHCs, but by the end of 2022, this number had decreased to 3713. This paper uses two specific selection criteria to construct

the sample: BHCs that remained publicly traded and consistently submitted to the FR Y-9C report throughout the analysis period. Only 110 BHCs met these criteria.

The choice of the time span was driven by several reasons. First, data collection and analysis were conducted in mid-2023, meaning that the most recent available financial data at that time were from the end of 2022. Second, the rationale for this time span was based on technical considerations associated with the quantile analysis of Machado and Santos Silva (2019). In this quantile regression, estimators are biased when the number of BHCs (n) is large relative to the number of time periods (T), with a general recommendation that $n/T \leq 10$. For clarification, dividing 110 BHCs by 10 years (2013–2022) results in a ratio of 11, which would provide biased estimators. To avoid such bias, the maximum available time span provided by FFIEC dataset, starting from the year 2000, was selected.

3.2. Variables Description

This paper evaluates bank value through the market-to-book ratio, a metric that provides a perspective looking forward and is strongly linked with the performance of banks (Gross, 2006). It assesses credit risk using the ratio of net charge-offs, as this measurement is less sensitive to managerial discretion (Calomiris & Nissim, 2014). Adopting the approach of Deng and Elyasiani (2008), this paper defines M&A activities using a dummy variable, which is set to one for banks engaged as bidders in M&A transactions, and only for the years in which those transactions are completed. This categorical variable is treated as the moderating variable. To assess its moderating effect, it is multiplied by the net charge-offs ratio to obtain the interaction term, as Namazi and Namazi (2016) illustrate in their conceptual analysis of the moderator.

This paper includes control variables for a range of bank-specific factors. Fu et al. (2014) find that bank size affects value positively until the synergetic gains from M&A are realized. While Pástor and Pietro (2003) observe that younger institutions are valued higher for their profit potentials, Modigliani and Miller (1958) clarify that highly leveraged corporations are expected to offer higher returns due to concentrating risk into a small portion of capital. Tampakoudis et al. (2020) find that liquid banks better exploit the economic benefits of M&A activities. Asimakopoulou and Athanasoglou (2013) observe that markets react to M&A between banks depending on the expected efficiency gains from those activities. Markowitz (1952) demonstrates how diversification enhances the expected returns at a given level of risk. Avramidis et al. (2018) find that markets incorporate future growth potential in income and market share into stock prices. Fama and French (1992) demonstrate how the expected returns of securities are related to their degree of sensitivity to market movements. Aharony and Swary (1980) observe that markets strongly react to dividend announcements. Handorf (2011) finds that the tax status of banks influences their values.

In addition to controlling for bank-specific factors, this paper controls for macroeconomic conditions. Given that the data are from one country, it is adequate to incorporate just a single macroeconomic variable for capturing the variations from year to year. Demirgüç-Kunt and Huizinga (2010) totalize the overall economic conditions in the growth rate of real gross domestic product (GDP). The descriptions of the variables used in this paper, along with their symbols, formulas and sources, are presented in Table 1.

Table 1. Variables list.

Description	Symbol	Formula	Source
Dependent Variable			
Market-to-Book Ratio	M/B	$\text{Log}\left(\frac{\text{Share Price}}{\text{Share Book Value}}\right)$	The YCharts, logged by the author.
Independent Variables			
Net charge-off Ratio	NCO	$\frac{(\text{Charge-offs} - \text{Recoveries})}{\text{Average Gross Loans and Leases}}$	Calomiris and Nissim (2014).
M&A	MA	Equals 1 for banks involved in M&A as bidders and only in the years those events are completed, 0 otherwise	Deng and Elyasiani (2008).
Interaction term	NCO × MA	NCO × MA	By the author.
Controls			
Bank Size	SIZE	$\text{Log}(\text{Total Assets})$	Deng and Elyasiani (2008).
Bank Age	AGE	Number of years since a bank was established.	Pástor and Pietro (2003).
Profitability Ratio	ROA	$\frac{\text{Net Income}}{\text{Total Assets}}$	Deng and Elyasiani (2008).
Leverage Ratio	LEV	$\frac{\text{Total Liabilities}}{\text{Total Assets}}$	Pástor and Pietro (2003), numerator adjusted by the author.
Liquidity Ratio	LIQ	$\frac{\text{Cash and Balances}}{\text{Total Assets}}$	Rose (1987).
Efficiency Ratio	EFF	$\text{Log}\left(\frac{\text{Total Expenses}}{\text{Total Revenues}}\right)$	Simoens and Vennet (2021), logged by the author.
Diversification Ratio	DIV	$1 - \left 2\left(\frac{\text{Gross Loans and Leases}}{\text{Total Assets}}\right) - 1 \right $	Baele et al. (2007).
Income Growth Rate	INCG	$\left(\frac{\text{Current Year Interest Income}}{\text{Previous Year's}}\right) - 1$	Avramidis et al. (2018), interest income is chosen by the author.
Market Share Growth Rate	MSHARE	$\left[\left(\frac{\text{Current Bank's Loans and Leases}}{\text{Banking Industry's}}\right) - \frac{\text{Previous Year's}}{\text{Previous Year's}}\right] - 1$	Avramidis et al. (2018).
Market Risk	BETA	$\frac{\text{Cov}(\text{Equity Return, S\&P500 Return})}{\text{Var}(\text{S\&P500 Return})}$	The YCharts.
Dividend Payout Ratio	DPR	$\frac{\text{Common Cash Dividends}}{\text{Net Income}}$	Knapp et al. (2005).
Effective Tax Rate	ETR	$\frac{\text{Income Taxes}}{\text{Pre-Tax Income}}$	Rose (1987).
Real GDP Growth Rate	GDP	Annual % Change	The IMF.

3.3. Empirical Analysis

To demonstrate the statistical necessity of preferring quantile regression over classical conditional mean regression, specifically the ordinary least squares (OLS) model, this paper initially examines the residuals obtained from OLS to determine whether they adhere the Gauss theorem (Dodge, 2008), with a specific focus on the Breusch–Pagan/Cook–Weisberg test for heteroskedasticity (Cook & Weisberg, 1983), Wooldridge test for autocorrelation (Drukker, 2003), and Shapiro–Francia W' test for normality (Royston, 1983). Additionally, the multicollinearity among variables is examined via the correlation matrix and the Variance Inflation Factor (VIF) (Belsley et al., 1980). The stationarity status of the variables is checked via the Karavias and Tzavalis (2014) (K&T) test, which is robust to non-Gaussian distributions. This stationarity test is particularly suitable when the cross-sectional dimension exceeds the time dimension, and when cross-sections are correlated. The existence of cross-sectional dependence (CD) among variables is checked via Pesaran's CD test (Pesaran, 2021). The K&T test can accommodate for intercepts or both intercepts and linear trends; therefore, for each variable, an average line graph across all cross-sections over time is

illustrated to detect linear trends (Wang et al., 2018). The K&T test allows for structural break(s); therefore, the test is performed via bootstrapping to determine the break(s), where the number of bootstrap replications is set to 200, as Efron and Tibshirani (1994) suggest this number as the minimum threshold for bootstrapping.

Koenker and Bassett (1978) introduce conditional quantile regression, which, through minimizing asymmetrically weighted absolute residuals rather than minimizing sums of squared residuals as in classical linear regression, offers estimations of a full range of conditional quantile functions beyond the conditional mean function. This approach is much more capable of providing a complete statistical analysis of the stochastic relationships between variables. Additionally, quantile regression outperforms the conditional mean function as it is robust over a wide class of non-Gaussian error distributions. By incorporating the variables of this paper into quantile regression, the model is presented in Equation (1):

$$Q_{y_{it}}(\tau|x_{it}) = \alpha_i + \beta_0 NCO_{it} + \beta_1 MA_{it} + \beta_2 (NCO \times MA_{it}) + \sum_{k=14}^K \beta_k x_{it}^k + \mu_{it} \quad (1)$$

where $Q_y(\tau|x_{it})$ denotes the quantile distribution of the dependent variable, M/B. NCO , MA , and $NCO \times MA$ represent the predictor, moderator, and the interaction term, respectively. x_{it}^k comprises the matrix of controls (SIZE, AGE, ROA, LEV, LIQ, EFC, DIV, INCG, MSHARE, BETA, DPR, ETR, INF, FED). τ represents the sample quantile, where τ is a set of deciles: 0.10, 0.20, ..., up to 0.90. The estimated parameters are α and β . While i denotes the cross-sectional dimension, t denotes the time dimension. μ is the error term.

The ninth decile regressions were estimated simultaneously to obtain the full covariance matrix of coefficients. This allowed us to test the coefficient equality across quantiles via the Wald test. In order to run simultaneous regressions, the estimation was performed via bootstrapping (Cameron & Trivedi, 2022). As Jiang and Zhang (2017), and this paper utilized the Wald test for equality of slopes testing for pairwise quantiles, and constructed a matrix of cross-pairwise quantile comparison, as in Nguyen (2020). The number of bootstrap replications was set to 200.

For quantile regression applied to longitudinal data, endogeneity is an important concern. Ignoring it will lead to an inconsistent estimation of the parameters (Koenker et al., 2017). Endogeneity often arises when there are omitted variables (Wooldridge, 2010). Incorporating individual fixed effects into the model specification mitigates the risk of omitted variable bias. This approach considers effects that are unobserved, constant over time, and specific to different individuals (Baltagi, 2021). To determine the adequacy of including these fixed effects to the model, the Wald test evaluates whether their dummy coefficients significantly differ from zero in least square dummy variable (LSDV) regression (Cameron & Trivedi, 2022).

Incorporating individual fixed effects in their dummy form into the quantile regression proposed by Koenker and Bassett (1978) is not recommended, as they cause incidental parameter bias and an inconsistent estimation of parameters. Therefore, many statistical solutions have been introduced to overcome the limitations of including fixed effects in quantile regression, such as penalizing, smoothing, and jackknifing. However, these solutions present significant implementation challenges due to their complexity (Koenker et al., 2017). Fortunately, Machado and Santos Silva (2019) introduce the Quantiles via Moments estimator (MM-QR), which combines the location and scale functions. This method identifies the same conditional quantiles as those estimated using the usual asymmetric loss function of Koenker and Bassett (1978).

The MM-QR model shows its superiority over other quantile regressions with fixed effects methods in four ways. First, it shares most robustness properties with Koenker and Bassett (1978) quantile regression, yielding the same inherently robust conditional quantile

estimators. Second, it is well-suited to panel data analysis, as it allows for methods limited to conditional means regression—such as incorporating individual fixed effects—to be applied in a quantile regression framework. Third, it avoids incidental parameter bias when including fixed effects in the quantile regression model. Fourth, it is simple to implement, as it does not require additional complex techniques such as penalizing, smoothing, and jackknifing to yield consistent estimates. By incorporating the variables of this paper and the individual fixed effect into quantile regression, the MM-QR model is presented in Equation (2):

$$Q_{y_{it}}(\tau|x_{it}) = (\alpha_i + \delta_i(\tau)) + \beta_0 NCO_{it} + \beta_1 MA_{it} + \beta_2 (NCO \times MA_{it}) + \sum_{k=14}^K \beta_k x_{it}^k + \gamma z'_{it}(\tau) + \mu_{it} \quad (2)$$

where $\alpha_i + \delta_i(\tau)$ is the distributional individual fixed effect. z' is a k -vector of known differentiable transformations of the components of x . δ and γ are unknown parameters. All other symbols are defined as in Equation (1).

Fortunately, the MM-QR model also provides simultaneous regression via bootstrapping to obtain the entire covariance matrix of variables to test the coefficient equality across quantiles via the Wald test. The number of bootstrap replications was set to 200.

4. Empirical Results and Discussion

Table 2 summarizes the descriptive statistics for the dependent variable, independent variables, and controls. The variable M/B is expressed in logarithmic term; thus, values above zero correspond to a non-logarithmic M/B greater than one, while values below zero indicate it is less than one. Given that the average M/B is 0.39, it suggests that banks are generally valued at a premium compared to their book value. The values of standard deviation, minimum, maximum, skewness, and kurtosis for the M/B suggest a wide dispersion around the mean and the presence of outliers. The 10th percentile of the M/B is -0.09 , suggesting that 10% of the bank-year observations in the panel data are valued at a discount compared to their book value. The high transition from the median to the 90th percentile indicates a substantial percentage of bank-year observations with high valuations. The average NCO is approximately zero, suggesting that banks generally incur small percentages of credit losses. However, the data reveal a dispersion around the NCO mean and highlight the presence of outliers. The upper percentile shows that at least 10% of the bank-year observations have incurred higher percentages of credit losses compared to the rest. The mean MA suggests that approximately 15% of bank-year observations involve M&A bidding activities. Given the binary nature of MA, elaborating on other descriptive statistics is not meaningful. Additionally, it makes the statistics of $NCO \times MA$ insubstantial for interpretation.

All the statistics of the controls in Table 2 reveal a highly diverse sample of banks, ranging from those with assets in hundreds of millions to those exceeding trillions of dollars, and ranging from startup to mature institutions. The sample consists of both losing and profitable banks, with reasonable to extreme levels of leverage. It features liquid and illiquid, efficient and inefficient banks, and those specialized either in interest income or fee income. Additionally, it encompasses banks with and without growth capabilities, and those that move aligned to or against the market. The sample also includes banks that pay dividends despite losses, alongside those that receive tax credits. The macroeconomic environment experiences phases of expansion and recession. Despite the diversity in the sample and the varying macroeconomic conditions, all controls exhibit skewed distributions, with a high likelihood of outliers, as indicated by the skewness, kurtosis, and percentiles statistics.

Table 2. Descriptive statistics.

Variables	Mean	SD	Min	Max	Skew	Kurt	p10	p50	p90
M/B	0.39	0.44	−1.65	2.09	−0.32	4.28	−0.09	0.38	0.94
NCO	0.00	0.01	0.00	0.09	4.72	35.76	0.00	0.00	0.01
MA	0.15	0.35	0.00	1.00	1.98	4.94	0.00	0.00	1.00
NCO × MA	0.00	0.00	0.00	0.02	7.20	78.07	0.00	0.00	0.00
SIZE	22.74	1.77	19.56	28.95	1.18	4.44	20.86	22.38	25.16
AGE	30.80	15.49	1.00	110.00	1.70	7.81	15.00	29.00	47.00
ROA	0.01	0.01	−0.08	0.04	−4.97	49.60	0.01	0.01	0.02
LEV	0.90	0.02	0.81	0.98	−0.41	3.49	0.87	0.90	0.92
LIQ	0.02	0.01	0.00	0.18	2.72	19.24	0.01	0.02	0.04
EFF	−0.36	0.14	−1.02	0.48	0.20	6.39	−0.53	−0.36	−0.21
DIV	0.66	0.17	0.09	1.00	−0.11	2.59	0.44	0.66	0.90
INCG	0.07	0.17	−0.43	1.42	1.77	10.58	−0.10	0.04	0.27
MSHARE	0.05	0.15	−0.42	1.95	3.75	29.36	−0.07	0.02	0.20
BETA	0.86	0.74	−1.87	6.95	0.88	7.57	0.00	0.83	1.72
DPR	0.35	0.74	−20.26	5.39	−16.87	445.43	0.07	0.36	0.61
ETR	0.16	3.56	−175.63	8.28	−47.80	2354.51	0.16	0.28	0.36
GDP	0.02	0.02	−0.03	0.06	−1.00	4.84	0.00	0.02	0.04

Note: all numbers have been rounded to two decimal places. SD, Min, Max, Skew, Kurt, and p denote standard deviation, minimum, maximum, skewness, kurtosis and percentile, respectively.

The K&T test in Table 3 demonstrates that all variables are stationary, either by controlling for CD as detailed in the same table or by including time trends in SIZE and AGE, as illustrated in Figure 1. Furthermore, Table 4 verifies that all variables are free from multicollinearity, as indicated by the absence of very strong pairwise correlations and VIF values below five. These results permit performing linear regressions as presented in Table 5.

Table 3. Cross-sectional dependence and stationarity tests.

Variables	Pesaran's CD	Karavias and Tzavalis
M/B	188.94 ***	−7.97 ***
NCO	200.30 ***	0.00 ***
MA	4.33 ***	0.00 ***
NCO × MA	1.92 *	0.00 ***
SIZE	332.86 ***	0.00 *** C&T
AGE	371.33 ***	0.00 *** C&T
ROA	112.16 ***	0.00 ***
LEV	115.96 ***	0.00 ***
LIQ	245.23 ***	0.00 ***
EFF	141.29 ***	−0.49 ***
DIV	31.72 ***	−0.17 ***
INCG	176.07 ***	−3.76 ***
MSHARE	21.66 ***	−3.73 ***
BETA	116.22 ***	−55.06 ***
DPR	13.51 ***	−23.38 **
ETR	82.13 ***	−83.01 ***
GDP	371.33 ***	−0.14 ***

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Pesaran's CD test's null hypothesis (H_0): there is no cross-sectional dependence across panel groups. Karavias and Tzavalis test's H_0 : there is unit root in panel time series. C&T denote including constant and trend.

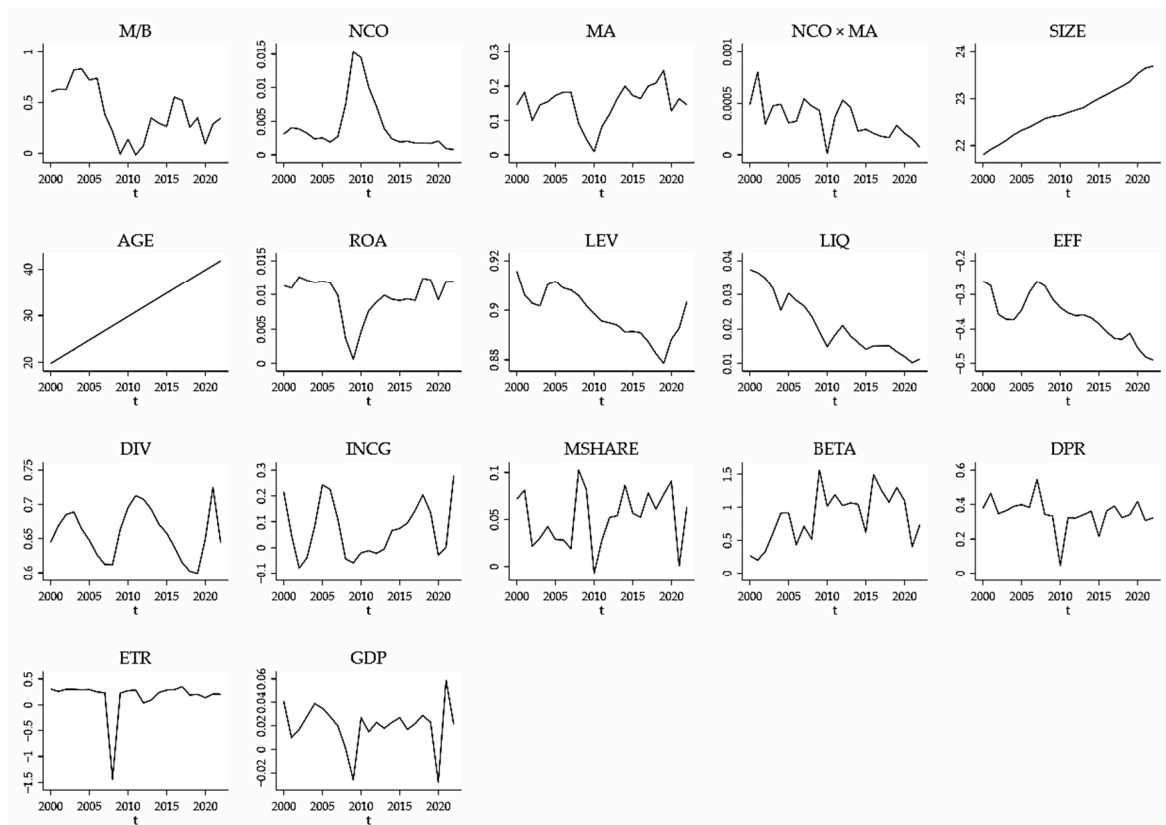


Figure 1. Time trends. Source: the author.

Table 4. Correlation matrix and VIF.

Variables	NCO	MA	NCO × MA	SIZE	AGE	ROA	LEV	LIQ	EFF	DIV	INCG	MSHARE	BETA	DPR	ETR	GDP
NCO	1.00															
MA	−0.11	1.00														
NCO × MA	0.05	0.61	1.00													
SIZE	0.17	0.05	0.10	1.00												
AGE	0.08	0.00	0.04	0.65	1.00											
ROA	−0.63	0.02	−0.04	0.02	0.06	1.00										
LEV	0.06	−0.15	−0.03	−0.13	−0.13	−0.20	1.00									
LIQ	−0.02	−0.01	0.05	−0.16	−0.17	0.12	0.19	1.00								
EFF	0.26	0.00	0.06	−0.20	−0.21	−0.59	0.39	0.17	1.00							
DIV	0.04	−0.01	0.00	0.07	0.13	0.08	−0.03	0.12	−0.06	1.00						
INCG	−0.29	0.30	0.12	0.03	−0.03	0.17	0.02	−0.03	−0.08	−0.10	1.00					
MSHARE	−0.17	0.42	0.24	−0.01	−0.07	0.00	−0.04	−0.05	−0.03	−0.06	0.44	1.00				
BETA	0.23	−0.02	−0.03	0.27	0.20	−0.14	−0.15	−0.20	−0.10	−0.01	−0.05	−0.01	1.00			
DPR	−0.10	0.06	0.09	−0.01	0.02	0.09	−0.01	0.02	−0.05	0.03	0.03	0.05	−0.04	1.00		
ETR	−0.02	−0.04	−0.06	0.01	0.01	0.02	0.01	0.01	−0.06	−0.01	0.03	0.00	0.00	−0.12	1.00	
GDP	−0.23	0.06	−0.02	−0.02	−0.03	0.26	0.06	0.07	−0.05	0.03	0.25	−0.11	−0.20	−0.02	0.03	1.00
VIF	2.07	1.96	1.68	1.92	1.82	2.86	1.27	1.22	2.00	1.06	1.51	1.55	1.21	1.04	1.03	1.26

Table 5 presents the coefficient results of OLS regression. While NCO and MA are statistically significant, NCO × MA is insignificant. Despite these results, the residuals obtained from OLS do not adhere to the Gauss theorem. They are homoscedastic, autocorrelated, and non-normally distributed. Therefore, quantile regression is preferable over OLS regression.

Table 6 presents the quantile regression coefficients. The independent variables show limited significant coefficients. NCO is significant between p10 and p60, while MA is significant between p20 and p80. NCO × MA is only significant at p70 and p90. Furthermore,

Table 7 evaluates the equality of coefficients across quantiles. Nearly half of the NCO and most of MA results are insignificant, and all $NCO \times MA$ results are insignificant.

Table 5. Linear regressions.

Dependent Variable = M/B	OLS	LSDV
Independent Variables		
NCO	−7.2960 ***	−15.4036 ***
MA	0.0773 ***	0.0656 ***
$NCO \times MA$	−10.1255	−16.2707 ***
Controls		
SIZE	−0.0001	−0.0838 ***
AGE	−0.0013 **	−0.0193 ***
ROA	15.5078 ***	3.8797 **
LEV	5.6536 ***	3.8575 ***
LIQ	7.1701 ***	−0.5444
EFF	−0.6635 ***	−0.8169 ***
DIV	0.1420 ***	0.0909 **
INCG	0.1550 ***	0.2521 ***
MSHARE	0.0236	0.0108
BETA	0.0028	0.0106
DPR	0.0262 ***	0.0091
ETR	−0.0032 *	−0.0040 **
GDP	2.6873 ***	2.7168 ***
constant	−5.3351 ***	−1.0349 *
Fixed Effects	No	Yes
Adjusted R ²	38.99%	59.46%
F-Statistic	102.03 ***	30.68 ***
Breusch–Pagan/Cook–Weisberg test	321.06 ***	226.44 ***
Wooldridge test	110.07 ***	110.07 ***
Shapiro–Francia W' test	9.47 ***	9.57 ***
Wald test (F-Statistic)		12.64 ***

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. F-Statistic H_0 : all the coefficients of the regressors (except the intercept) are all equal to zero. Breusch–Pagan/Cook–Weisberg test's H_0 : residuals are homoscedastic. Wooldridge test's H_0 : residuals do not exhibit first-order autocorrelation. Shapiro–Francia W' test's H_0 : residuals are normally distributed. Wald test's H_0 : the fixed effects are all equal to zero.

Table 6. Quantile regression.

Dependent Variable = M/B	p10	p20	p30	p40	p50	p60	p70	p80	p90
Independent Variables									
NCO	−22.6626 ***	−12.3573 ***	−9.0234 ***	−7.6371 ***	−8.1064 ***	−6.8825 ***	−3.3195	−0.2989	0.0769
MA	0.0499	0.0731 ***	0.0949 ***	0.0814 ***	0.0768 **	0.0779 **	0.0979 ***	0.0573 **	0.0175
$NCO \times MA$	−4.8713	−9.2050	−14.9524	−4.7116	−12.7490	−13.4062	−16.6437 *	−7.6556	−16.2837 **
Controls									
SIZE	0.0069	0.0051	−0.0012	−0.0021	−0.0008	0.0024	−0.0039	0.0005	−0.0146
AGE	−0.0012	−0.0017 **	−0.0015 **	−0.0016 **	−0.0018 ***	−0.0019 ***	−0.0018 **	−0.0020 ***	−0.0002
ROA	25.0897 ***	28.0013 ***	27.2737 ***	24.9028 ***	24.6989 ***	20.5535 ***	21.6981 ***	21.4231 ***	17.1716 ***
LEV	4.3201 ***	5.5494 ***	6.0420 ***	6.5570 ***	7.3296 ***	7.6136 ***	7.5687 ***	8.0115 ***	6.8071 ***
LIQ	6.0398 ***	7.2641 ***	8.2825 ***	7.9999 ***	8.3159 ***	8.1960 ***	7.7924 ***	8.1331 ***	8.9044 ***
EFF	−0.5374 ***	−0.5313 ***	−0.6531 ***	−0.7180 ***	−0.7185 ***	−0.8115 ***	−0.7011 ***	−0.7326 ***	−0.5723 ***
DIV	0.1302 *	0.1066 **	0.0901 **	0.0563	0.0768	0.1026 **	0.0818 *	0.0957 *	0.1503 **
INCG	0.1465 *	0.0695	0.0398	0.0713	0.0645	0.0737	0.1002	0.1522 **	0.1037
MSHARE	−0.0190	0.0458	0.0839	0.0319	0.0427	0.0601	0.0845	0.1726 *	0.3289 ***
BETA	0.0471 ***	0.0345 ***	0.0255 **	0.0229 *	0.0171	−0.0016	−0.0078	−0.0138	−0.0134
DPR	0.1229 ***	0.1402 ***	0.1250 ***	0.0921 ***	0.0681 **	0.0321	0.0120	0.0007	−0.0032
ETR	0.0081	0.0219	−0.0031	−0.0033	−0.0036	−0.0039	−0.0037	−0.0036	−0.0028
GDP	2.3460 ***	1.7868 ***	1.8645 ***	2.2995 ***	2.3017 ***	2.7792 ***	2.1396 ***	2.1597 ***	2.8824 ***
Constant	−4.7032 ***	−5.6743 ***	−5.9492 ***	−6.2713 ***	−6.9106 ***	−7.1450 ***	−6.8376 ***	−7.2763 ***	−5.7261 ***

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. p denotes percentile. The estimated coefficients have been bootstrapped with 200 replications.

Table 7. Coefficients equality test—quantile regression.

Variable = NCO	p20	p30	p40	p50	p60	p70	p80	p90
p10	9.30 ***	12.51 ***	12.20 ***	9.85 ***	11.41 ***	14.44 ***	18.09 ***	15.70 ***
p20		2.91 *	3.59 *	1.86	2.97 *	6.33 **	10.84 ***	7.74 ***
p30			0.99	0.20	1.00	4.22 **	8.92 ***	5.25 **
p40				0.08	0.18	3.07 *	8.06 ***	3.88 **
p50					0.73	4.57 **	9.62 ***	4.62 **
p60						3.74 *	10.04 ***	3.52 *
p70							2.47	0.96
p80								0.01
Variable = MA	p20	p30	p40	p50	p60	p70	p80	p90
p10	0.53	1.39	0.62	0.38	0.36	1.09	0.03	0.37
p20		0.85	0.11	0.01	0.02	0.49	0.19	1.51
p30			0.45	0.40	0.26	0.01	1.05	2.82 *
p40				0.04	0.02	0.33	0.53	2.15
p50					0.00	0.68	0.40	2.00
p60						0.84	0.45	2.09
p70							3.11 *	4.53 **
p80								1.55
Variable = NCO × MA	p20	p30	p40	p50	p60	p70	p80	p90
p10	0.24	1.09	0.00	0.49	0.55	0.92	0.05	0.82
p20		0.64	0.23	0.11	0.15	0.39	0.01	0.30
p30			2.18	0.06	0.03	0.03	0.40	0.01
p40				1.66	1.24	1.68	0.08	1.02
p50					0.01	0.22	0.28	0.11
p60						0.20	0.37	0.08
p70							1.22	0.00
p80								1.21

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. p denotes percentile. Wald test's H_0 : the difference between the coefficient estimates at different quantiles equal to zero.

Due to the endogeneity concerns highlighted by the LSDV results in Table 5, which show the relevance of incorporating individual fixed effects into the model, incorporating these fixed effects increased the adjusted coefficient of determination (R^2) from 38.99% to 59.46%, providing a more accurate assessment of the predictors' explanatory power on the variation in the M/B. Consequently, Table 8 re-estimates the quantile regression using the MM-QR method, which incorporates individual fixed effects.

The results of Table 8 are partially consistent with those in Table 6. The variables NCO, MA, and $NCO \times MA$ become significant at all percentiles. The effect of NCO on the M/B is consistently negative across these percentiles. This negative impact of credit risk decreases in magnitude from the 10th percentile to the 90th percentile of bank value, suggesting a stronger detrimental effect on banks with lower valuations compared to those with higher valuations. The findings from Table 8 align with the results in Table 9, which indicate that the coefficients for NCO are not equal across different M/B percentiles. These findings strongly support H_1 —the effect of credit risk on bank value varies significantly across quantiles of bank value. The consistent decrease in the negative effect of credit risk, as observed ascending through bank value percentiles, can be explained through the contributions of (Fama & French, 1992, 1998). In asset-pricing models, the value premium suggests that stocks with higher valuations are less risky compared to those with lower valuations. In the banking sector, the risk–return principle exhibits an inverse shape. Investors accord higher valuations to banks with lower credit risk over those with higher credit risk (Avramov et al., 2009). This anomaly is attributed to the fact that cumulative credit losses put banks in a financial distress phase (Kanas et al., 2012). Additionally, Jensen and Meckling (1976) highlight that lower risk-taking incentives exist in highly profitable institutions. Yet, profitability stands as an important determinant in value creation for banks (Handorf, 2011).

Table 8. Quantiles via Moments.

Dependent Variable = M/B	p10	p20	p30	p40	p50	p60	p70	p80	p90
Independent Variables									
NCO	−21.6469 ***	−19.4463 ***	−17.8513 ***	−16.4604 ***	−15.2972 ***	−14.1140 ***	−12.7901 ***	−11.1797 ***	−9.2253 ***
MA	0.0704 **	0.0687 ***	0.0675 ***	0.0664 ***	0.0655 **	0.0646 **	0.0636 **	0.0624 *	0.0609 *
NCO × MA	−13.1560 *	−14.2539 **	−15.0496 **	−15.7435 **	−16.3238 **	−16.9141 **	−17.5745 **	−18.3779 **	−19.3529 **
Controls									
SIZE	−0.1150 ***	−0.1040 ***	−0.0961 ***	−0.0891 ***	−0.0833 ***	−0.0774 **	−0.0708 **	−0.0627 *	−0.0530
AGE	−0.0148 ***	−0.0164 ***	−0.0175 ***	−0.0185 ***	−0.0194 ***	−0.0202 ***	−0.0212 ***	−0.0223 ***	−0.0237 ***
ROA	11.6265 ***	8.8959 ***	6.9168 **	5.1909 *	3.7476	2.2795	0.6368	−1.3615	−3.7865
LEV	3.3334 ***	3.5181 ***	3.6520 ***	3.7688 ***	3.8665 ***	3.9658 ***	4.0769 ***	4.2121 ***	4.3762 ***
LIQ	−1.6174	−1.2392	−0.9651	−0.7261	−0.5261	−0.3228	−0.0953	0.1815	0.5174
EFF	−0.8265 ***	−0.8231 ***	−0.8207 ***	−0.8185 ***	−0.8167 ***	−0.8149 ***	−0.8128 ***	−0.8103 ***	−0.8073 ***
DIV	0.1252	0.1131	0.1044	0.0967	0.0903	0.0838	0.0765	0.0676	0.0569
INCG	0.1698 ***	0.1988 ***	0.2198 ***	0.2381 ***	0.2535 ***	0.2691 ***	0.2865 ***	0.3078 ***	0.3335 ***
MSHARE	−0.0465	−0.0263	−0.0117	0.0011	0.0118	0.0226	0.0347	0.0495	0.0675
BETA	0.0272 *	0.0214 *	0.0171	0.0134	0.0104	0.0072	0.0037	−0.0006	−0.0058
DPR	0.0118	0.0109	0.0102	0.0095	0.0090	0.0085	0.0079	0.0072	0.0063
ETR	−0.0053	−0.0049	−0.0045	−0.0042	−0.0040	−0.0038	−0.0035	−0.0031	−0.0027
GDP	2.1902 ***	2.3758 ***	2.5104 ***	2.6277 ***	2.7258 ***	2.8256 ***	2.9373 ***	3.0731 ***	3.2380 ***

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. p denotes percentile. The estimated coefficients have been bootstrapped with 200 replications.

Table 9. Coefficients equality test—Quantiles via Moments.

Variable = NCO	p20	p30	p40	p50	p60	p70	p80	p90
p10	8.30 ***	8.97 ***	9.17 ***	9.09 ***	8.99 ***	9.17 ***	9.43 ***	9.34 ***
p20		9.40 ***	9.58 ***	9.34 ***	9.14 ***	9.33 ***	9.63 ***	9.48 ***
p30			9.08 ***	8.99 ***	8.81 ***	9.15 ***	9.55 ***	9.40 ***
p40				8.33 ***	8.38 ***	8.98 ***	9.52 ***	9.34 ***
p50					7.99 ***	9.08 ***	9.75 ***	9.45 ***
p60						9.67 ***	10.28 ***	9.67 ***
p70							10.39 ***	9.48 ***
p80								8.40 ***
Variable = MA	p20	p30	p40	p50	p60	p70	p80	p90
p10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
p20		0.05	0.05	0.05	0.05	0.05	0.05	0.05
p30			0.05	0.05	0.05	0.05	0.05	0.05
p40				0.05	0.05	0.05	0.05	0.05
p50					0.05	0.05	0.05	0.05
p60						0.05	0.06	0.05
p70							0.06	0.05
p80								0.05
Variable = NCO × MA	p20	p30	p40	p50	p60	p70	p80	p90
p10	0.37	0.38	0.38	0.38	0.37	0.37	0.38	0.37
p20		0.39	0.38	0.38	0.37	0.38	0.38	0.37
p30			0.37	0.37	0.37	0.37	0.38	0.37
p40				0.38	0.36	0.37	0.38	0.37
p50					0.35	0.37	0.38	0.37
p60						0.37	0.39	0.37
p70							0.39	0.37
p80								0.35

Note: *** denote significance at the 1% levels, respectively. p denotes percentile. Wald test's H_0 : the difference between the coefficient estimates at different quantiles equal to zero.

The findings on MA in Table 8 are consistent with those in Table 9. Bank value is positively affected by horizontal M&A. However, the magnitude of this effect remains positive and is relatively stable across all M/B percentiles. Thus, the posed H_2 —the effect of horizontal mergers and acquisitions on bank value varies significantly across quantiles of bank value—cannot be supported, suggesting that the linear prediction of the success or

failure of M&A is adequate as long as the Gauss theorem is not violated. The magnitude of the effect of horizontal M&A on bank value appears to be influenced by factors beyond the M/B of the acquiring banks, such as the size of acquirer. Alexandridis et al. (2017) show that the dynamics of wealth creation in M&A change based on acquirer size, with smaller banks outperforming large banks in wealth creation. This is supported by DeYoung et al. (2009), who suggest that the primary cause for large banks to engage in M&A is for building an empire, rather than wealth creation. In general, market power and operational synergies from M&A create value (Krishnan & Yakimenko, 2022); managerial biases and skewed managerial incentives demolish it (Sudarsanam, 2012). Our findings suggest that the potential advantages of horizontal M&A among banks surpass the drawbacks.

The findings of $NCO \times MA$ in Table 8 are inconsistent with those in Table 9. The moderating effect of horizontal M&A on the credit risk–bank value relationship is significant across all M/B percentiles. The interaction term shows negative signs across them all, meaning that horizontal M&A amplify the initial negative effect of credit risk on bank value across the distribution. The negative magnitude of the interaction term increases as moving from the 10th to the 90th percentile. However, Table 9 shows that variations in the interaction term's coefficients across M/B percentiles are not sufficient to be considered statistically different from one another. Thus, the posed H_3 —the moderating effect of horizontal mergers and acquisitions on the credit risk–bank value relationship varies significantly across quantiles of bank value—cannot be supported. The rejection of H_2 and H_3 does not diminish the research contribution because H_1 is accepted. The three hypotheses should be viewed together in a moderating framework. The variation in the effect of NCO on the M/B across quantiles indicates that the credit risk–bank value relationship is not uniform across different bank value levels. Therefore, even if the effects of MA and NCOMA on the M/B are stable, the inclusion of NCO necessitates analyzing these effects across the quantiles of M/B. Furthermore, the non-Gaussian nature of the error term distribution, along with evidence of heteroskedasticity, autocorrelation, and fixed effects, justifies the use of Quantiles via Moments in this study. Given the lack of significant heterogeneity in the slopes of the moderator and the interaction term, and assuming the Gauss theorem holds, examining the posed H_3 in a quantile regression method is deemed more superior than linear methods due to the strong slope heterogeneity exhibited by the NCO. Yet, the findings imply that while horizontal M&A events by themselves enhance bank value, they diminish value when interacting with credit risk. The theoretical benefits of diversification and co-insurance effect, as outlined in (Lewellen, 1971; Markowitz, 1952), appear to be either absent in M&A among banks or, if present, exert a limited influence. Horizontal M&A either develop homogenized internal structures, eliminating potential diversification benefits (Wang, 2024), or they generate diversification advantages that are subsequently offset by exploiting them to increase the riskiness of the loan portfolio post-M&A, aiming to generate higher returns and boost stock prices (Knapp & Gart, 2014). However, this risky portfolio escalates credit losses, restricting profit making and impeding value creation (Shirasu, 2018). Markets evaluate banks differently than other institutions, and they favor soundness over risk (Avramov et al., 2009); thus, when M&A between banks lead to credit quality issues, markets react negatively and strongly (Knapp et al., 2005).

The robustness of our MM-QR results is validated through a series of multiple checks: variables validity, conditional quantile validity, fixed effects validity, bootstrapping, and consistency validity. First, we confirm that the variables are free of multicollinearity and unit root issues, as addressed in Tables 3 and 4 and Figure 1, using correlation matrix and VIF (Belsley et al., 1980), Pesaran's CD test (Pesaran, 2021), average line graphs (Wang et al., 2018), and the K&T test (Karavias & Tzavalis, 2014). Second, we illustrate that the conditional quantile regression of Koenker and Bassett (1978) outperforms conditional

mean regression by effectively handling the non-Gaussian residuals (Royston, 1983), heteroskedasticity (Cook & Weisberg, 1983), and autocorrelation (Drukker, 2003) in OLS and LSDV regressions, as presented in Table 5. Third, using the Wald test (F-Statistic), we reveal in Table 5 the necessity of including individual fixed effects in the conditional quantile regression to avoid issues in endogeneity and omitted variable bias. As such, necessity cannot be directly implemented in the Koenker and Bassett (1978) model due to incidental parameter bias (Koenker et al., 2017). Therefore, we introduce the MM-QR of Machado and Santos Silva (2019), which can include individual fixed effects in the quantile regression model without such bias. Fourth, all results presented in Tables 6 and 8 are derived via bootstrapping, ensuring robust estimates (Efron & Tibshirani, 1994). Furthermore, the partial consistency of the MM-QR results in Table 8 with those from the Koenker and Bassett (1978) quantile regression in Table 6, as well as the OLS and LSDV results in Table 5, and with similar outcomes of hypotheses testing using the Wald test in Tables 7 and 9, further validate the robustness of our results.

Finally, Table 8 reveals several statistically significant coefficients for control variables across all bank value percentiles. Although the equality of coefficients of these controls is not tested, it can be considered that there are initial relationships that need to be further examined. While AGE has an increased negative effect, EFF has a diminished negative impact. The static negative influence of both variables is aligned with Pástor and Pietro (2003), as investors value younger institutions higher due to their growth potential, and Asimakopoulou and Athanasoglou (2013), as markets react to expected efficiency gains from M&A activities. LEV, INCG, and GDP all have an increasing positive effect. The static impact of these variables is aligned with Modigliani and Miller (1958), as highly leveraged institutions are expected to yield higher returns; Avramidis et al. (2018), as markets incorporate the growth potential into stock valuations; and Teixeira et al. (2014), as banking activity correlates with the expansionary phase of the economy.

5. Conclusions

This paper aims to evaluate the moderating effect of horizontal mergers and acquisitions (M&A) on the relationship between credit risk and bank value across different quantiles of bank value. Furthermore, it investigates how credit risk and horizontal M&A influence bank value within these same quantiles. The most interest in predicting credit risk lies within quantiles, owing to non-linear processes and deviations from the Gauss theorem. Furthermore, the complex nature of M&A limits the ability to predict their outcomes linearly. To our knowledge, the existing literature has not provided an explanation of the credit risk and bank value relationship in the context of horizontal M&A that accounts for the potential non-linear behavior and the variability across different quantiles of bank value. This research bridges this gap, adopting a distinctive approach that utilizes the revolutionary Quantiles via Moments estimator to address endogeneity concerns, ensuring the robustness of our findings. Consequently, this study contributes to the academic field by revealing the non-linear dynamics of how credit risk and bank value interrelate under the conditions of horizontal M&A.

The findings indicate a significant variation in the effect of credit risk on bank value across the entire distribution of bank value. However, the results fail to provide statistical evidence to support a significant variation in the effect of horizontal M&A on bank value, as well as in their moderating effect on the relationship between credit risk and bank value, across the entire distribution of bank value. Given the significant non-linear behavior in the credit risk–bank value relationship, evaluating it within the scope of horizontal M&A using quantile analysis enhances the precision and accuracy for decision making. This remains valid despite the linear nature of M&A's direct and moderating effects, as well as

deviations from the Gauss theorem. The effect of credit risk on bank value is negative and becomes less pronounced for higher-valued banks; meanwhile, although the direct effect of horizontal M&A on bank value is positive, their moderating effect is negative, providing valuable implications for investors, practitioners, and policymakers.

Investors should assess the risk profile and value proposition of a bank before making investment decisions in banking stocks. They can include credit risk as a dynamic asset-pricing factor that rewards more for value stocks than growth stocks. Similarly, in horizontal M&A, they should consider credit risk as a dynamic pricing determinant for deal offers that potentially reduces the bidding offer and lowers it further for low-valued targets. Additionally, investors in banking stocks should diversify their portfolio not just across different banks but also across banks positioned at different quantiles of value to mitigate risks associated with fluctuations in bank value relative to credit risk.

For practitioners, it is crucial to integrate credit risk management along with bank value proposition. If their banks are valued lower, they should adopt a more stringent strategy to mitigate credit risk. Similarly, when incorporating horizontal M&A into their strategic growth plans, they should also be more stringent in mitigating credit risk.

Policymakers should acknowledge the varying effect of credit risk on bank value across different thresholds of value. It is advisable to implement a dynamic regulatory framework for the permissible percentage of exposure to credit risk in banks based on their value proposition. They should foster healthy M&A between banks as long as they do not compromise financial stability. It is advisable to establish capital buffers for horizontal M&A in the banking sector, designed to safeguard against both foreseen and unforeseen credit risk that may emerge after M&A. These buffers should be calibrated according to credit risk and bank value parameters.

This paper has two limitations that prevent the generalization of its results. First, due to the challenge of accessing data from banking sectors outside the U.S., the sample is limited to U.S. banks; thus, our findings may not be applicable to different jurisdictions. Second, given the complexities involved in applying non-market-based valuation techniques, the sample is limited to publicly traded banks; thus, our results may not extend to privately held banks. Hence, future researchers could broaden the scope of this study by considering banks on a global scale, incorporating non-listed banks, or undertaking both approaches.

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Article

The Effect of Cross-Border Mergers and Acquisitions Performance on Shareholder Wealth: The Role of Advisory Services

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Abstract: This study empirically examines the wealth effects of mergers and acquisitions (M&As) in the Indian capital market, focusing on cross-border M&As. This study considers a sample of 58 cross-border and 34 domestic M&As, comprising more than 50 percent of the shares acquired by the acquiring companies from 2004 to 2019. We analyzed the wealth effects of cross-border M&As by applying the event study methodology. The abnormal returns of domestic and cross-border mergers and acquisitions for various window periods were compared using an independent *t*-test. The wealth effects of the acquiring firm have been further investigated with the inclusion of top advisor services and without the inclusion of advisor services in mergers and acquisitions transactions. This result suggests that cross-border M&As do not create a significant positive return for shareholders. There is no considerable wealth gain for shareholders of acquiring companies in domestic and cross-border mergers and acquisitions. We also find that including top advisor services in the M&A process does not influence the acquiring firm's wealth. The price-to-book value ratio of the acquiring firm is a significant determinant of its returns.

Keywords: mergers and acquisitions; event study; abnormal return; advisory services

1. Introduction

The success of cross-border mergers and acquisitions (M&As) is significantly influenced by financial performance and M&A activity (Fieberg et al., 2021). Businesses from emerging markets (EMFs) are increasingly participating in cross-border M&As to speed up their international market expansion (Clampit et al., 2023). Cross-border investments by Indian companies over the last decade have also witnessed an increasing trend due to several strategic factors.

While exploitation-oriented acquisitions seek to bolster existing technologies and skills, exploration-oriented acquisitions seek to uncover and build new information, technology, and capabilities. Certain purchases have both an exploration and an exploitation focus. Businesses can use different forms of acquisition to introduce various types of information. Businesses that prioritize learning new things and starting over often employ acquisitions that are focused on discovery. Acquisitions with an eye toward exploitation are preferred by businesses that concentrate on improving their present expertise and strengthening the learning process (Zhang et al., 2020).

Although M&As have received extensive consideration in the literature, few studies have examined the wealth effects of cross-border M&As in the Indian setting. Further, few studies have reported the positive and significant impact of M&As on the shareholder wealth of acquiring companies, while others have reported negative and significant returns for the shareholders of acquiring companies. The lack of clarity regarding the wealth effect of M&A's announcements on stock returns using market-based measures requires further research. A plethora of studies have used market-based measures, such as Travlos (1987), Bradley et al. (1988), Kaplan and Weisbach (1992), Smith and Kim (1994), Yuce and Ng (2005), and Sudarsanam and Mahate (2003), in developed economies such as the US, Canada, and the UK Kingdom. However, studies conducted in India covering market-based measures, such as Mishra and Goel (2005), Kashiramka and Rao (2014), and Rani et al. (2013), have provided diverse results in terms of value creation to the shareholders of acquiring companies.

More recently, Chaudhry et al. (2021) studied firm mergers in the US context and concluded that a large number of central M&A's advisors lead to higher acquirer announcement returns. Similarly, McCarthy and Noseleit (2021) examined the influence of multiple advisors and the moderating impact of advisor reputation/quality and deal timing in US M&As. They find support for the value-creating role of single advisors. Furthermore, they reported that the moderating effect of advisor reputation and deal timing is dependent on firms' advisor strength. Feng et al. (2023) examined the transmission role of M&A's advisors during takeovers amidst economic distress. They found a significant and positive association between the M&A's advisors and industry takeover behaviors.

Overall, the literature supports the positive impact of M&A's advisors in developed countries, especially in the U.S. context. However, empirical studies on emerging economies are limited. This study attempts to evaluate the performance of a merger in the Indian context by comparing wealth gains in domestic and cross-border mergers and acquisitions. In addition, the role of the inclusion of advisor services that influence the wealth creation process of M&A's has been investigated. Accordingly, this study is divided into five sections: Section 1 describes the introduction, Section 2 discusses the related literature, Section 3 describes the sample and methodological framework, Section 4 presents the empirical results, and Section 5 presents the conclusion and implications.

2. Literature Review and Hypothesis Development

Many studies have been conducted from the perspective of domestic and cross-border M&A. Some researchers argue that cross-border M&As yield standard returns, while others argue that cross-border M&As deliver substantial wealth gains for the acquiring firm to the acquiring firm's shareholders. We reviewed some studies related to domestic and cross-border M&As abroad. The results are presented in Table 1.

More recently, Chen et al. (2022) studied the relationship between cross-border M&As on CSR performance and spending among Chinese firms. Their findings indicate a significant increase in CSR activities and spending post-acquisition. Another study in the Chinese context by Cheng et al. (2023) examined the necessity of aligning commercial and social reasonings to address external institutional pressures in cross-border acquisitions. The authors found that structured interaction is important for the effective combination of different institutional logics in cross-border M&As.

Table 1. Overview of studies on domestic and cross-border mergers and acquisitions abroad.

Authors	Sample Periods	Sample Size	Market	Methodology	Findings
Eckbo and Thorburn (2000)	1964–1982	1846	Canada	Event Study	Domestic acquirers earn significantly higher wealth gains than cross-border acquirers.
Goergen and Renneboog (2004)	1993–2000	187	Europe	Event Study Methods and OLS Regression	Acquirers experience a positive abnormal return in a cross-border transaction; however, cross-border merger acquirers earn more as compared to domestic mergers.
Campa and Hernando (2004)	1998–2000	262	Europe	Event Study and OLS Regression	Acquirers' return on average is zero, and there is a significant positive return to the target shareholder of cross-border mergers, with acquirers earning less as compared to domestic mergers.
Aw and Chatterjee (2004)	1991–1996	79	UK	Event Study	Negative return to both the acquirer and target shareholder. The UK acquirer is superior in domestic acquisitions as compared to foreign acquisitions.
Conn et al. (2005)	1984–1998	4000	UK	Event Study, BHAR, and OLS Regression	Negative return to the acquirer firms in a cross-border transaction. Cross-border acquisitions earn less wealth gains than domestic acquisitions.
Aybar and Ficici (2009)	1991–2004	433	58 EM	Event Study and OLS Regression	Negative abnormal return for the acquirer.
Uddin and Boateng (2009)	1994–2003	373	UK	Event Study	The acquiring firms find a significantly negative abnormal return.
Martynova and Renneboog (2011)	1993–2001	2419	Europe and the UK	Event Study and OLS Regression	There are substantial share price increases at the announcement, most of which are captured by the target firm's shareholders.
Danbolt and Maciver (2012)	1980–2008	251	UK	Event Study and OLS Regression	Both the acquirer and the target firms gain more as compared to domestic acquisitions.
Inoue and Ings (2012)	2000–2010	198	Japan	Event Study	The shareholder of cross-border deals receives a more positive return as compared to a domestic one.
Dutta et al. (2013)	1993–2002	1300	Canada	Event Study, BHAR, and OLS Regression	Cross-border deals generate more return than domestic deals; however, stock finances show the positive and significant impact.
Gregory and O'Donohoe (2014)	1990–2005	119	UK	Event Study and OLS Regression	Cross-border performance is better as compared to domestic performance; however, the acquiring firm incurs losses in cross-border mergers.

Table 1. Cont.

Authors	Sample Periods	Sample Size	Market	Methodology	Findings
Sharma and Raat (2014)	2000–2011	125	DM	Event Study and OLS Regression	The developed market acquiring firm has a significant positive cumulative abnormal return in the three-day event window.
Tao et al. (2017)	2000–2012	165	China	Event Study	The stock market responded favorably and strongly, on average, according to Chinese listed corporations.
Liu et al. (2019)	2007–2012	86	China	DID Methods	The findings showed that domestic M&As outperformed cross-border M&As in terms of improving the firms' financial performances.
Zhang et al. (2020)	2000–2015	477	China	Event Study and Regression	Our analysis of cross-border M&A's data reveals that acquisitions focused on exploration perform worse on the stock market than those focused on exploitation.
Yuan et al. (2023)	2010–2019	1616	China	PSM_DID Methods	The outcome proved that domestic M&As can generate a higher market value than international M&As.

Note: EM: Emerging Market; DM: Domestic market.

In the Indian context, Chandrika et al. (2022) studied the impact of the home country's emissions on cross-border acquisition decisions in India. They found that firms from less carbon-emitting countries frequently engage in CBAs with large volumes in India, while high-emitting country firms prefer full equity control.

Boubakri et al. (2023) explored the dynamics of risk-taking in M&As, focusing on whether high-risk-taking firms acquire low-risk-taking firms by paying higher premiums and found evidence of a higher perceived valuation effect when high-risk-taking firms acquire lower-risk-taking targets. Recently, Basu et al. (2023) provided a positive linear association between effective democracy and inflows of foreign direct investment (FDI) and cross-border M&As, suggesting that democratic institutions play a crucial role in attracting foreign investment. Bao and Li (2023) examined the impact of cross-border M&As on board gender diversity among Chinese public firms and found that acquirers adjust the proportion of female directors to better align with the target country's gender-equal culture. Aleksanyan et al. (2020) investigated the relationship between state visits and cross-border M&A's activity and reported a positive relationship between state visits and M&A's activity.

Chaudhry et al. (2021) studied firm mergers in the US context and concluded that a large number of central M&A's advisors lead to higher acquirer announcement returns. Similarly, McCarthy and Noseleit (2021) examined the influence of multiple advisors and the moderating impact of advisor reputation/quality and deal timing on large US acquisitions and evaluated the impact of advisors using an event study and abnormal returns. They also found support for the value-creating role of single advisors, but found little support for the use of multiple advisors.

Overall, the literature on cross-border M&As has focused on several important dimensions including CSR, external institutional factors, environment pollution, governance, corruption and country-level democracy, cultural factors, and bilateral relations as important factors influencing M&As (Chen et al., 2022; Cheng et al., 2023; Chandrika et al., 2022). These different dimensions highlight the complicated nature of cross-border M&As and their broader implications for firms, stakeholders, and host countries. However, recent

studies in the Indian context are limited. In the same context, we examine the wealth effects of cross-border mergers and acquisitions (M&As). Specifically, we compared the wealth effects of domestic and cross-border M&A's transactions.

Additionally, we analyze the influence of advisory services on wealth creation in M&As. Finally, we investigate the key determinants of wealth creation in both domestic and cross-border M&As, identifying the factors that influence transaction performance, including deal type, advisor involvement, method of payment, acquirer size (measured by market capitalization), and price-to-book value ratio.

More specifically, we test the following hypothesis:

H₁. *Cross-border M&As generate higher shareholder returns (wealth effects) than domestic M&As.*

H₂. *Financial advisors' involvement in M&As has a positive impact on shareholder wealth.*

H₃. *The wealth effects of M&As are influenced by factors such as deal type (domestic vs. cross-border), advisory services, payment method, acquirer size, and price-to-book value ratio.*

3. Data and Methodology

3.1. Sample Selection

The sample includes 92 deals to analyze the effects of domestic and cross-border M&As. We used the venture intelligence database of mergers and acquisitions to collect data on domestic and cross-border acquisitions and acquisitions during the period from 2004 to 2019. The period after 2019 was excluded from the study to eliminate the effect of COVID-19 on the sample companies' returns. The sample is restricted only to M&As where the acquiring companies acquire more than 50 percent control of the target company. These companies have been deleted when the mode of financing and adjusted closing price data are not available and are required for this study. The final sample consists of 92 M&A's deals, comprising 34 domestic M&As and 58 cross-border M&As.

3.2. Data Sources

Data relating to domestic and cross-border M&A's in the sample period were obtained from Venture Intelligence database. Adjusted closing price data of the acquiring companies and the BSE Sensex index adjusted closing price were used as a proxy for market return and were collected from Prowess, a database developed by the Center for Monitoring Indian Economy (CMIE Prowess). Stock exchange announcement dates taken as event dates were collected from the CMIE Prowess database.

3.3. Empirical Methods

We employ the event study methodology to gauge the wealth implications for acquiring firms engaged in both domestic and cross-border M&As. Our approach uses a market model to compute the abnormal returns of these acquiring companies. The estimation of the model parameters for each acquiring firm was conducted over a specified estimation window ranging from 121 to 20 trading days before the event date. This methodology allowed us to examine the wealth effects across different time frames, including the announcement, pre-announcement, and post-announcement periods. To comprehensively analyze the market performance of mergers, we employed the event study methodology with a market model. By examining the short-term impact of mergers on market performance during the pre-announcement, post-announcement, and around-the-announcement periods, we sought to derive valuable insights. To assess the impact of these events, we focus on abnormal returns as a pivotal measure, as it facilitates the isolation of event-specific effects from broader market fluctuations. Specifically, the cumulative abnormal return (CAR) of the acquiring companies is determined through a series of steps. It is important to note that

CAR pertains to the difference between the realized and expected returns, assuming that the event had not occurred. This CAR calculation was pivotal in elucidating the financial implications and market reactions associated with domestic and cross-border M&As. In this study, event dates were carefully selected to ensure the absence of other significant events, thereby maintaining the independence of each event. Consequently, the likelihood of external events influencing the observed outcomes was minimized.

This research approach allows us to provide a comprehensive assessment of how these mergers affect the wealth of acquiring companies across various time frames and provides a valuable understanding of short-term market dynamics and their impact on these firms. The following steps were taken to calculate the cumulative abnormal return of the acquiring companies:

$$r_{i,t} = \ln(P_{i,t}) - \ln(P_{i,t-1}) \quad (1)$$

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (2)$$

$$CAR_{i,T_1,T_2} = \sum_{t=T_1}^{T_2} AR_{i,t} \quad (3)$$

$$CAAR(T_1, T_2) = \frac{1}{N} \sum_{i=1}^N CAR_{i,T_1,T_2} \quad (4)$$

In Equation (1), we calculate the log returns of the stocks selected for analysis. In Equation (2), we calculate abnormal returns by comparing the actual and expected returns using the market model. In Equation (3), we calculate the CAR over time to measure the total impact of the M&A's over the event window. In Equation (4), we calculate Cumulative Average Abnormal Return (CAAR), which is the average across firms, to assess the overall market response.

We use an independent *t*-test to compare the wealth gains of domestic and cross-border mergers and acquisitions. We conduct a mean difference *t*-test between the CAARs of domestic and cross-border transactions for the event window. Furthermore, we divide the sample into two sets to analyze the effects of advisor services.

4. Empirical Results

In this section, we analyze the short-term wealth effects of domestic and cross-border M&As using the event study methodology. First, the abnormal returns of the acquiring companies in the cross-border M&As have been listed for different window periods. This comparative analysis of domestic and cross-border M&As provides insight into the integration of the Indian market into the world capital market. Thus, this study analyzes the abnormal gains in the effect of measuring the difference in domestic and cross-border M&As.

We analyze the short-term wealth effects for cross-border M&As for the different window periods for pre-announcement periods, post-announcement periods, and around-the-announcement periods. We analyze the abnormal returns for the different observed periods. This analysis indicates the effects of wealth on acquiring firms through cross-border mergers and acquisitions.

Table 2 presents the CAAR results of acquiring companies in cross-border acquisitions during various window periods. The CAAR was calculated for the acquiring companies in different window periods using the event study methodology. The CAAR for the $[-10, 10]$ window period is -0.62% (*t*-stat = -0.318) which is negative and statistically insignificant. The CAAR for the $[-5, 5]$ window period is -1.60% (*t*-stat = -1.213), which is negative and statistically insignificant. The CAAR for the $[-1, 1]$ window period is -0.86% (*t*-stat = -1.260), which is also negative and insignificant. The CAAR for the $[-5, -1]$ window period is -1.40% (*t*-stat = -1.416), which is negative and insignificant, and that for the $[-10, -1]$ window period is -0.51% (*t*-stat = -0.417), which is negative

and insignificant. The CAAR for the [1, 5] window period is 0.17% (t-stat = 0.184), which is positive and insignificant, and that for the [1, 20] window period is 1.63% (t-stat = 0.8951), which is positive and insignificant. Thus, the CAAR for the post-announcement period is positive and insignificant in most window periods for cross-border M&As.

Table 2. Cumulative average abnormal return (CAAR) for cross-border mergers and acquisitions (N = 58).

Event Window	Positive:Negative	CAAR	t-Statistics	Prob.
[−20, 20]	29:29	0.018	0.586	0.557
[−10, 10]	26:32	−0.006	−0.318	0.750
[−5, 5]	22:36	−0.016	−1.213	0.224
[−1, 1]	17:41	−0.008	−1.260	0.207
[0]	22:36	−0.003	−1.089	0.276
[−1, 0]	19:39	−0.011	−1.846	0.064 **
[−5, −1]	23:35	−0.014	−1.416	0.156
[−10, −1]	24:34	−0.005	−0.417	0.676
[−20, −1]	30:28	0.005	0.304	0.761
[1, 5]	33:25	0.001	0.184	0.853
[1, 10]	36:22	0.002	0.240	0.809
[1, 20]	32:26	0.016	0.895	0.370

Note: ** denotes statistical significance at the 0.05 and 0.10 levels, respectively.

Three trends were identified in the above results. First, abnormal returns for the pre-announcement window period hurt shareholders. Second, the effect of abnormal returns on announcement days was negative. Third, the post-announcement abnormal return is positive but statistically insignificant to shareholders in most of the window periods considered in this study. We do not find any significant pre- or post-announcement effects for the selected window periods considered in this study.

Thus, we can conclude that the wealth effects in cross-border M&As do not create a statistically significant value for the acquiring firm's shareholders. The M&As carried out by Indian companies in other countries did not create significant value for the acquiring firm's shareholders. The findings of these studies suggest that no net benefits have been generated for the shareholders of companies that went for cross-border M&A. The Indian capital market is highly integrated into the global financial market.

The CAAR for the window period [−20, 20] is shown in Figure 1. The figure shows that there is a significant decline in the CAAR leading up to the event, indicating potential investor skepticism before the M&A's announcement. However, after the initial decline, the CAAR recovers and rises to its highest point post the event date. The results provide evidence that market participants react positively once the particulars of the M&A's deal become clear. The volatility seen in the CAAR after the announcement is made public suggests that it can be linked to investor reactions, due to information dissemination or external market factors. Finally, the CAAR shows a recovery, due to a longer-term positive market assessment of the cross-border M&A's potential benefits.

The results of the present study are similar to those of other studies conducted on cross-border M&As, such as Campa and Hernando (2004) and Lowinski et al. (2004).

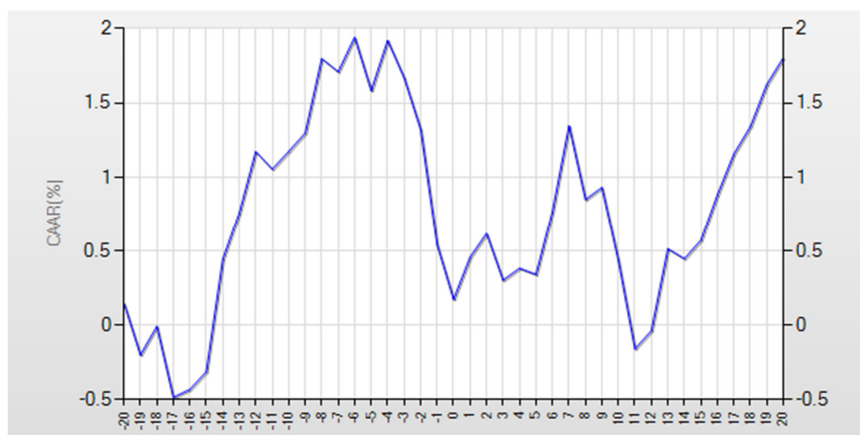


Figure 1. Cumulative average abnormal returns for the acquiring firms (cross-border merger).

4.1. Wealth Effects of Domestic and Cross-Border Mergers and Acquisitions

In the next section, we perform a comparative analysis of domestic and cross-border M&As for different window periods. We divide the total sample into domestic and cross-border M&As. Companies that acquire a target belonging within the geographical boundaries of the same country are considered domestic mergers and acquisitions, otherwise the target is outside the geographical boundaries of the country and is termed a cross-border merger and acquisition. We calculated the CAAR for 58 cross-border M&As and 34 domestic M&As. We calculated the CAAR for domestic and cross-border M&As for different window periods. We compared the M&A's effects of domestic and cross-border M&As. The significant difference between the CAAR of domestic and cross-border M&As was analyzed using a *t*-test.

Table 3 presents the results of the cumulative average abnormal return (CAAR) for domestic and cross-border mergers and acquisitions. Additionally, we compared the announcement of the effects of domestic and cross-border M&As for different window periods. For the observation periods in a pre-announcement period, the CAAR was found to be higher in domestic mergers than in cross-border mergers and acquisitions. During the observation period around the announcement period, the CAAR was found to be higher in domestic mergers than in cross-border mergers and acquisitions in the short-window period. The CAAR for the announcement date is 0.20% (*t*-stat = 0.447) for domestic M&As and −0.37% (*t*-stat = 1.089) for cross-border M&As. For the observation periods in the post-announcement window period [1, 5] and [1, 20], the CAAR is higher in cross-border M&As than in domestic M&As, but statistically insignificant. We conducted a mean difference of the CAARs between the domestic and cross-border M&As for the pre-announcement, post-announcement, and around-the-announcement period. We did not find any significant difference in the CAARs for domestic and cross-border M&A. The findings from Table 3 highlight differences in reactions of markets to domestic and cross-border M&As. In the case of the CAAR for cross-border M&As, there are both positive and negative returns depending on the event window, and domestic M&As have less volatility but a lower CAAR. The mixed findings indicate that cross-border transactions may lead to additional complications due to several factors including cultural differences, regulatory bottlenecks, and exchange rate changes leading to investor disbelief. On the contrary, local M&As are considered as less risky due to familiarity with domestic conditions.

It is also important to note that there is a significant negative CAAR in the [−1, 0] window for cross-border M&A's deals. The results indicate the possibility of market trepidation before announcements are made. On the contrary, during the post-announcement periods ([1, 5] or [1, 10]), in the case of cross-border M&As, there is a more positive trend, suggesting

that clarity of the details of the deal after the announcement can improve shareholders' returns. The above findings on cross-border effects are consistent with the findings of other studies abroad, such as Lowinski et al. (2004) and Campa and Hernando (2004). These findings are contrary to earlier Indian studies, such as Rani et al. (2014).

Table 3. Cumulative average abnormal return (CAAR) of acquirer for domestic and cross-border mergers and acquisitions.

Event Window	Domestic Mergers and Acquisitions			Cross-Border Mergers and Acquisitions			Effect of Cross-Border Mergers and Acquisitions		
	CAAR	t-Statistics	Prob.	CAAR	t-Statistics	Prob.	$CAAR_{CB} - CAAR_D$	t-Statistics	Prob.
[−20, 20]	−0.017	−0.433	0.665	0.018	0.586	0.558	0.035	−0.699	0.487
[−10, 10]	−0.002	−0.099	0.921	−0.006	−0.318	0.750	−0.004	0.121	0.904
[−5, 5]	−0.011	−0.661	0.508	−0.016	−1.214	0.225	−0.006	0.260	0.795
[−1, 1]	0.010	0.988	0.323	−0.009	−1.261	0.208	−0.019	1.578	0.118
[0]	0.002	0.448	0.654	−0.004	−1.089	0.276	−0.006	1.017	0.312
[−1, 0]	0.009	1.389	0.165	−0.012	−1.847	0.064 **	−0.021	2.160	0.334 *
[−5, −1]	−0.001	−0.113	0.910	−0.014	−1.417	0.157	−0.013	0.906	0.368
[−10, −1]	−0.009	−0.544	0.587	−0.005	−0.417	0.676	0.004	−0.200	0.842
[−20, −1]	−0.001	−0.044	0.965	0.005	0.304	0.761	0.006	−0.223	0.824
[1, 5]	−0.012	−1.043	0.297	0.002	0.184	0.854	0.013	−0.909	0.366
[1, 10]	0.005	0.302	0.763	0.003	0.241	0.810	−0.002	0.123	0.902
[1, 20]	−0.018	−0.634	0.526	0.016	0.895	0.371	0.035	−1.066	0.289

Note: *, ** denotes statistical significance at the 0.05 and 0.10 levels, respectively.

The results are also depicted in Figure 2. As shown in Figure 2, both domestic and cross-border M&As showcase an initial decline in the CAAR before the event date. However, the cross-border M&As show a greater positive trend following the event date compared to domestic M&As, suggesting a more favorable market perception in the medium term for cross-border M&As. Further, the CAAR displays significant volatility, but cross-border M&As recoup strongly post-announcement, whereas domestic M&As remain in a negative trajectory for a longer duration. It is also observed that cross-border M&As showcase a significant upward trend, peaking towards the end of the window, indicating that investors anticipate long-term benefits of these cross-border M&As.

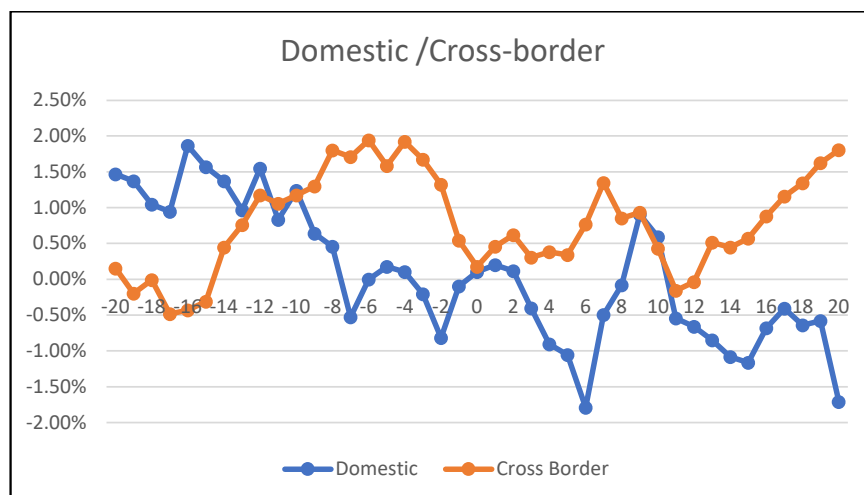


Figure 2. Cumulative average abnormal returns for the acquiring firms (domestic/cross-border merger).

4.2. Influence of Advisor Services on Wealth Effects Through Mergers and Acquisitions

Mergers and acquisitions (M&As) are technical and complex issues. Most of the time, the organization prefers to use the services of advisory firms while going for M&As. In this section, we test whether the inclusion of an advisor in the process of M&A's transactions creates value. We assume that the inclusion of advisory services creates more wealth for the acquiring company's shareholders. In this section, we analyze the wealth effect of advisory services in M&A's transactions. To do so, we analyzed the effects of M&As on the shareholder wealth of firms with and without advisors for different window periods. We conducted the mean difference *t*-test between the CAAR merger deals conducted with an advisor and without advisor services for the various event windows.

Table 4 presents the CAARs for the different window periods with the inclusion of advisor services and without the inclusion of advisor services in domestic and cross-border merger acquisitions. To analyze the effect of advisor services in M&As, we split the sample into two categories: M&As that leveraged the services of advisors and those that did not use any advisor services. We calculated the CAAR for both of the above conditions for different window periods. We observed a difference in the CAAR with or without the inclusion of advisor services for the $[-20, 20]$ window period of -1.25% ($t\text{-stat} = -0.241$), which is negative and statistically insignificant. The observed difference in the CAAR with and without the inclusion of advisor services for the $[-10, 10]$ window period is 3.45% ($t\text{-stat} = 1.063$), which is positive and insignificant, and for the $[-5, 5]$ window period is 0.20% ($t\text{-stat} = 0.0930$), which is positive but insignificant. The CAAR has been found to be statistically insignificant with and without advisor services for the selected window period around the announcement date.

Table 4. The CAAR for the acquiring companies with and without the advisor services.

Event Window	M&A's with Advisor Service			M&A's Without Advisor Service			Effect of Advisor Service		
	CAAR	t-Statistics	Prob.	CAAR	t-Statistics	Prob.	$CAAR_{WI} - CAAR_{WD}$	t-Statistics	Prob.
$[-20, 20]$	-0.003	-0.134	0.894	0.009	0.269	0.788	-0.013	-0.241	0.810
$[-10, 10]$	0.018	1.057	0.291	-0.016	-0.769	0.442	0.035	1.063	0.291
$[-5, 5]$	-0.013	-1.364	0.173	-0.015	-1.016	0.310	0.002	0.093	0.926
$[-1, 1]$	-0.001	-0.135	0.893	-0.002	-0.257	0.798	0.001	0.089	0.930
$[0]$	-0.002	-0.419	0.675	-0.002	-0.442	0.659	0.000	0.016	0.987
$[-1, 0]$	-0.003	-0.484	0.629	-0.004	-0.665	0.506	0.001	0.122	0.903
$[-5, -1]$	0.001	0.083	0.934	-0.014	-1.443	0.149	0.015	0.979	0.330
$[-10, -1]$	0.005	0.519	0.604	-0.012	-0.880	0.379	0.017	0.815	0.417
$[-20, -1]$	-0.003	-0.194	0.846	0.006	0.316	0.752	-0.009	-0.307	0.760
$[1, 5]$	-0.012	-1.265	0.206	0.001	0.094	0.925	-0.013	-0.840	0.403
$[1, 10]$	0.015	1.018	0.309	-0.002	-0.193	0.847	0.017	0.897	0.372
$[1, 20]$	0.001	0.059	0.953	0.005	0.222	0.824	-0.004	-0.106	0.916

We observed a difference in the CAAR for the announcement day window period of 0.01% ($t\text{-stat} = 0.016$), which is positive and statistically insignificant. The observed difference in the CAAR for the pre- and post-announcement periods was found to be insignificant in the observed window periods with or without the inclusion of advisor services in M&A's transactions, as presented in Table 4. Further, when we compare the deals in the two categories, i.e., with and without advisory services, it is clear that transactions with advisors yielded a more stable CAAR. The results provide preliminary evidence that although

advisory services do not lead to higher shareholders returns, they can play an important role in reducing risks associated with mergers and enhance stakeholder confidence.

Thus, we can conclude that there is no significant difference in abnormal returns due to the inclusion of advisor services in M&A's transactions. Thus, the inclusion of advisor services in M&A's transactions does not create value, on average, for the shareholders of the acquiring firms. A possible explanation is that significant fees are paid to obtain the services of advisors in M&A's transactions. The above findings on cross-border effects are consistent with the findings of other studies conducted in the internal context (Lowinski et al., 2004). These results are presented in Figure 3 wherein the line with M&As without advisory services showcases more volatility; especially, we see negative spikes before the event. The negative spikes and higher volatility indicate that M&A's transactions without advisory services display greater variability in the CAAR. The graph highlights the importance of taking services of advisory firms as the stability of the blue line suggests that advisory firms can play an important role in enhancing market perception and reducing risk.

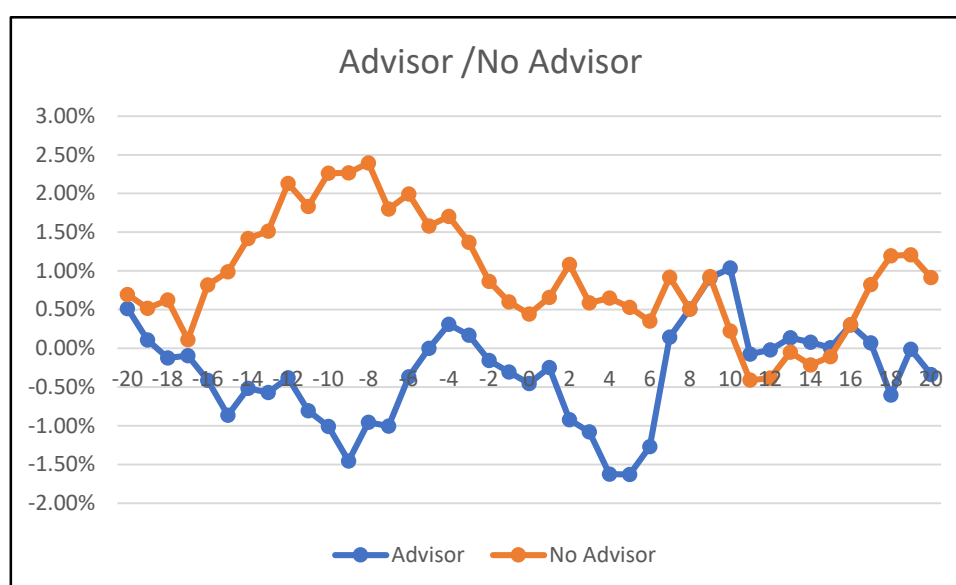


Figure 3. Cumulative average abnormal returns for the acquiring firms (advisor services/without advisor services).

Finally, we examine the factors that affect the performance of M&A's transactions in domestic and cross-border M&As. The factors that have been tested include cross-border merger deals, advisor services, method of payment, and size of the acquirer, which is measured by market capitalization and the price-to-book value ratio. We used three dummy variables for cross-border merger deals, advice on investment, and method of payment. The descriptive statistics of these variables are presented in Table 5.

Table 5 presents descriptive statistics of the variables used in the cross-sectional regression analysis. The explanatory variables include cross-border merger deals, advisor services, method of payment, size of the acquirer, and price-to-book value ratio. The cross-border deal indicates the identity of the target; if the target is from a foreign country, the variable is taken as one, and if the target is from the domestic country, it is zero. The variable for the inclusion of an advisor for the M&A's transaction is taken as a one and without advisor services is taken as zero to analyze the impact of advisor services on the returns of the acquiring firm. The mode of payment was used to measure the acquiring firm's returns. It takes the value of one if the acquisition is financed with cash and zero if it is financed with stock or otherwise. The size of the acquiring firm, measured by market capitalization, is considered one of the factors influencing the acquiring firm's return. The

price-to-book value ratio is used as one of the variables to analyze the impact of growth factors on the returns of the acquiring firm. The CAAR $[-10, 1]$ is taken as one of the dependent variables for the cross-sectional regression analysis to identify the factors that influence the returns of acquiring firms.

Table 5. Descriptive statistics.

Variables	N	Mean	Median	Std. Deviation	Minimum	Maximum
Cross-Border Target	92	0.630	1.000	0.485	0.000	1.000
Advice of Investment bank	92	0.326	0.000	0.471	0.000	1.000
Method of Payment	92	0.446	0.000	0.500	0.000	1.000
log size (Market Capitalization)	92	9.884	9.865	2.153	4.723	14.864
Price-to-book value ratio	92	0.883	0.862	0.850	−1.926	3.426
CAAR, $[-10, -1]$	92	−0.007	−0.011	0.095	−0.298	0.329

Several factors influence the wealth creation process in domestic and cross-border M&As. To test these determinants, we run the regression model using Equation (5). In Equation (5), we regress the bidder's CAAR $[-10, 1]$ on various explanatory variables to capture the factors that influence performance.

$$CAAR_{t,t} = \alpha + \beta_1 \text{Cross Border target} + \beta_2 \text{Payment method} + \beta_3 \text{Advisor Service} + \beta_4 \ln(\text{Market Capitalisation}) + \beta_5 \text{price to book value ratio} + \epsilon \quad (5)$$

where 'CAAR $_{[t,t]}$ ' is the dependent variable. This refers to the short-term abnormal return of the acquiring firm over the $(-10 \text{ to } 1)$ window period.

Table 6 shows the results of the regression model. Regression analysis was conducted to identify the determinants of value creation. The CAAR for the window period $[-10, 1]$ is taken as the dependent variable, and cross-border deal, advisor service, method of payment, log size, and price-to-book value ratio are taken as explanatory variables. It has been found from the result of the model that the coefficient of the cross-border deal ($\beta = -0.11$, t-stat = -0.522) is negative and statistically insignificant. The result indicates that cross-border deals have not generated more returns than domestic deals. These findings confirm earlier findings. The coefficient for the advisor service variable is positive and statistically insignificant ($\beta = 0.025$, t-stat = 1.667), indicating that there is no significant difference in the return of the acquiring firm when taking advisory services. The coefficient of the method of payment variable is positive and statistically significant ($\beta = 0.039$, t-stat = 1.959) at the 10% level. This signifies that a cash payment creates a positive and significant return to the acquiring firm's shareholders compared to a stock payment. The coefficient variable size was negative and statistically insignificant ($\beta = -0.008$, t-stat = -1.631), indicating that small acquiring companies generate more returns than large acquiring companies. The coefficient of the price-to-book value ratio used as a proxy for the growth firm is positive and statistically significant ($\beta = 0.08$, t-stat = 2.407), indicating that the growth firm created a positive and significant return to the acquiring firm's shareholders. The model R^2 explains the proportion of variation in the dependent variable explained by the independent variable. The R^2 in this model is 0.125, and the Durbin–Watson statistic is close to two.

Table 6. Regression results on the determinants of the acquiring company's shareholder wealth in domestic and cross-border mergers and acquisitions.

Variable	Coefficient
Constant	−0.014
Cross-border deals	−0.011
Advisor Services	0.025
Method of Payment	0.039 **
Log size (Market Capitalization)	−0.008
Price-book-value ratio	0.080 *
N	92
R Squared	0.125
Adjusted R-squared	0.074
Durbin–Watson statistic	2.029
F-Value	2.464
Probability (F-stat)	0.039 *

Note: *, ** denotes statistical significance at the 0.05 and 0.10 levels, respectively.

5. Conclusions and Implications

This study empirically examines the wealth effects of M&As in the Indian capital market, focusing on cross-border M&As. This study has taken a sample of 58 cross-border M&As and 34 domestic M&As, specifically for cases in which more than 50 percent of shares were acquired by the acquiring companies for the period 2004–2019. We analyzed the wealth effects of cross-border M&As by applying the event study methodology. We also compared the performance of domestic and cross-border M&As. The wealth effects of the acquiring firm have been further analyzed with the inclusion of top advisor services and without the inclusion of advisor services in the process of merger and acquisition transactions. We also investigated the factors that influence domestic and cross-border M&As using regression analysis.

This result suggests that the cross-border wealth creation process for Indian acquiring companies has not created a significant positive return. There are no significant wealth gains for shareholders of acquiring companies in domestic and cross-border mergers and acquisitions. The results indicate probable disbelief among Indian investors towards cross-border M&A's. The rising cynicism calls for a robust risk management strategy to be followed by managers before going for cross-border M&As. Management should employ resources to effectively communicate the objectives of going for cross-border M&As in order to minimize investor concerns.

We also find that the inclusion of top advisor services in the M&A's process does not influence the acquiring firm's wealth. We find no significant positive wealth effect on the acquiring firm with or without the inclusion of top advisor services in M&A's transactions for the different observed window periods. However, our results also reveal that transactions with advisory services have a more stable CAAR. The results, therefore, underscore the importance of advisory services in stabilizing the CAAR which is crucial for any firm in the long run.

We also found strong evidence that the means of payment have a significant impact on the performance of the acquiring firm. The cash payment method has a positive impact compared with the stock method of payment. The price-to-book value ratio of the acquiring firm is a significant determinant of its returns. We find no evidence that size determinants influence the returns of acquiring firms in domestic and cross-border M&As.

These results have important implications for Indian market investors. Because international M&As have not generated significant shareholder wealth, investors should exercise caution when investing in firms engaged in cross-border M&A's transactions. Moreover, the insignificant impact of advisory services suggests marginal benefits of such services, as such services reduce volatility but may have an additional financial burden on firms and, therefore, not contributing much to shareholders value creation.

Furthermore, the failure of international M&As to enhance shareholder wealth indicates that Indian companies may struggle to realize the expected synergies from cross-border deals. This can be attributed to integration challenges, policy uncertainty, or cultural differences.

Additionally, the positive impact of cash-based transactions suggests that investors should favor cash-financed deals over stock-based deals because the latter may signal overvaluation or dilution concerns.

Finally, future research should explore long-term impacts considering other factors that may influence shareholder wealth, including corporate governance variables, macroeconomic conditions, cultural differences, and economic policy uncertainty, which were not examined in the present study. Research should also examine the qualitative factors which have an impact on M&A's transactions.

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