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Corporate Finance and Environmental, Social, and Governance (ESG) Practices

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Ştefan Cristian Gherghina

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Editor

Ștefan Cristian Gherghina

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Contents

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Editorial

Corporate Finance and Environmental, Social, and Governance (ESG) Practices

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As global warming progresses, implementing green finance to redirect resources into sustainable initiatives has emerged as a crucial strategy for governments to develop financial systems that are carbon-free, green, and sustainable (Jin et al. 2024). Hence, there has been an increase in stakeholder pressure on executives and boards of directors to prove that their enterprises are operated ethically and integrate green practices into their corporate image (Arduino et al. 2024). Considering the growing shift in investor sentiment toward these ecologically sensitive issues, stakeholders are becoming more concerned with different facets of companies instead of just their turnover, and thus, they prefer to allocate their funds to firms that operate transparently, use green practices, and promote equitable society (Sariyer et al. 2024). Fiorillo and Santilli (2024) reported a beneficial connection between company ESG performance and shareholder goals, emphasizing the need to align investor preferences with corporate sustainability targets. Hence, the increasing relevance of environmental, social, and governance (ESG) considerations signals a substantial change in how investors, stakeholders, and the general public perceive enterprises (Rahat and Nguyen 2024). ESG is an extension of Corporate Social Responsibility (CSR) and an essential metric to assess companies' commitment to environmental preservation and sustainable development (Niu and Wang 2024). The "E" pillar addresses the industrial influence on the natural landscape (Senadheera et al. 2021). The "S" dimension reflects the company's effect on the societal systems in which it runs (Baid and Jayaraman 2022). The "G" component outlines the way power of decision is allocated among different groups of stakeholders within a corporation (Lehn 2021). Therefore, the ESG concept is an effective tool on the path to achieving the "carbon neutral" target (Chen et al. 2023). Additionally, the long-term growth, competitiveness, and overall advancement of a firm's global sustainable development are contingent upon its ESG performance (Zhang et al. 2024c).

The incorporation of ESG factors into investment evaluation and selection is also supported by the Principles for Responsible Investment (2017). Additionally, the Sustainable Stock Exchanges Initiative (2015) is a networking framework that evaluates how partnerships among policymakers, regulators, investors, and companies might promote responsible investment for sustainable development (Sustainable Stock Exchanges Initiative 2015). In this vein, a growing number of companies are including ESG components into their strategy design to boost their brand, acquire investments, and achieve a competitive edge (Xue et al. 2024). Zhang et al. (2024a) proved that superior ESG performance promotes investment due to benefits such as an enhanced reputation, cost savings, and sustainable access to marketplaces. Han and Wu (2024) reinforced that boosting company value is supported by higher corporate ESG ratings. Additionally, Rahman and Wu (2024) showed that targets with strong ESG performance might support acquirers to enhance their own ESG performance, which boosts market valuations. On the contrary, Duuren et al. (2016) underscored that inadequate social and environmental leadership might hinder the ability of a company to operate effectively. For instance, Wong and Zhang (2024) argued that when opposing views of ESG intensify, investors penalize the stock price of companies with extra

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cash. In the same vein, Xue et al. (2023) emphasized that ESG conflicts might adversely affect a business's ability to invest, which may result in inadequate funding.

Putting emphasis on initiatives related to sustainability while assigning company funds would be beneficial for managers and decision makers (Ademi and Klungseth 2022). Hence, those in leadership positions view ESG as a reliable mechanism for investing, even at the expense of the company's long-term worth (He et al. 2023). Additionally, the mitigation of firm risk is an essential component in a company's ability to maximize its profits and achieve sustainability (Chen et al. 2024). Thus, Zhang et al. (2024b) supported the idea that strengthening ESG performance may effectively reduce a company's risk of litigation. Bonacorsi et al. (2024) argued that companies that operate in areas with stringent carbon emission standards or higher data security face lower credit risk. Moreover, Luo et al. (2024) confirmed that good ESG performance decreases the risk of collapses in the stock market.

Companies might experience expenses and constraints as a consequence of their ESG projects, but they might also be offered premium pricing from the capital markets (Hsu and Huang 2024). It is imperative for executives to understand that ESG is a powerful tool that can yield financial and non-financial benefits for their companies (Pinheiro et al. 2024). Moreover, incorporating ESG elements into investment and strategic decision-making practices may be effective throughout periods of instability (Ricci et al. 2024). As such, Wang et al. (2024) highlighted that firms with higher ESG performance tend to be more resilient, and Gao and Geng (2024) confirmed that companies with strong ESG performance fare better during times of crisis. Baek and Song (2024) proved that the volatility of equity returns is usually lower for firms with high ESG performance compared to enterprises with poorer ESG performance. Moalla and Dammak (2023) stated that good ESG performance lowers stock price volatility and stabilizes stock prices during turbulent times. Likewise, Broadstock et al. (2021) proved the endurance of stocks with strong ESG performance during market-wide financial meltdowns. By examining organizations that have various ESG ratings, Saci et al. (2024) found that companies with higher scores are much less vulnerable to systemic risk.

Institutional investors, rating agencies, and consumers expect corporations to be transparent regarding their ESG achievements (Veltri et al. 2023). Kimbrough et al. (2024) noticed that when firms willingly release ESG reports, there are fewer disagreements among ESG rating agencies. Consequently, Veeravel et al. (2024) supported the idea that firm performance is strengthened by ESG disclosure scores, while He and Ismail (2024) acknowledged that the cost of corporate debt financing can be considerably reduced through ESG information reporting. Furthermore, according to Malik and Kashiramka (2024), ESG disclosure is also considered by financial markets for lenders when assessing creditworthiness.

This book comprises 12 papers published in the Special Issue entitled "Corporate Finance and Environmental, Social, and Governance (ESG) Practices", addressing a wide range of topics related to corporate reporting (sustainability reporting; environmental accounting information disclosure and financial risk; compulsory preliminary profit and loss disclosure and stock prices; capital expenditure and ESG disclosure; and International Financial Reporting Standards (IFRS) disclosure and the cost of equity capital); essential drivers of enterprise value (the mediating role of ESG scores in the association between board gender diversity and firm value; promoters' holdings, institutional holdings, dividend payout ratio and firm value; leverage and firm value; sustainable finance, capital and firm value); the impact of agency issues, as well as ESG, socially responsible investing (SRI), ethical investing, and impact investing, on corporate performance; and perspectives concerning the way the automobile sector is evolving to produce zero-emission vehicles.

With reference to corporate reporting, Contribution 1 conducted an extensive review of the reporting on sustainability. The authors highlighted the benefits of sustainability reporting, which promotes accountability and transparency and notifies stakeholders of the company's economic, social, and environmental performance. With respect to the Vietnamese stock market, Contribution 2 examined the link between environmental ac-

counting information disclosure and corporate financial risk. The release of environmental accounting information has been found to have an adverse effect on financial risk in both the current and subsequent year. Contribution 3 explored whether Korea's obligatory preliminary profit and loss disclosure policy impacted stock prices and revealed that the effect of corporate financial disclosure may differ depending on the category of the stock market and industry sector. The impact of capital expenditure on ESG disclosure and the moderating role of corporate governance were examined in the UK setting in Contribution 4. The outcomes revealed that capital expenditure and ESG disclosure exhibit a positive relationship, which is stronger for companies with more effective corporate governance. Contribution 5 explored the effect of implementing IFRS on the cost of equity capital for listed firms located in the European Union, and found an adverse relationship between the two factors.

Regarding the underlying factors that influence firm value, Contribution 6 focused on how ESG scores mediate the connection between board gender diversity and company value in Saudi Arabia. The empirical results showed that the presence of a female director had a positive relationship with ESG scores, but a negative link was found between the presence of a female director and firm value. Considering the Indian context, Contribution 7 assessed the link between promoter and institutional holdings and the dividend payout ratio and firm valuation. The outcomes suggested a beneficial connection between the selected variables. Moreover, listed non-financial firms in India were also investigated by Contribution 8, which examined the influence of debt ratio on firm value and established that leverage ratio adversely impacts company valuation. Contribution 9 examined the effects of sustainable finance and the capital adequacy ratio on company value in the banking sector within the context of the ASEAN stock market. Empirical evidence suggested that sustainable finance and capital have a significant impact on corporate value.

Contribution 10 focused on the agency problem and its impact on financial performance and highlighted the significance of making sound decisions to mitigate agency issues while boosting company performance. The purpose of Contribution 11 was to analyze the body of research on the effects of ESG, SRI, and ethical and impact investing on portfolio and financial performance. The findings suggested that managers can mitigate risks, make better-informed investment decisions, and take chances to achieve sustainable growth by incorporating ESG elements and being actively involved within corporations.

Contribution 12 explored the automotive market's economic and technological components, with a focus on the challenges associated with electric motorization. It was concluded that implementing a transition to electro-motorization is feasible when cars are powered by renewable energy sources, and battery and component fabrication has no environmental impact.

In brief, with underpinnings in ethics and sustainability, ESG factors offer investors a broad perspective to assess possibilities and risks and pinpoint paths to long-term value creation (Zhang et al. 2024a). Hence, the mainstreaming of ESG considerations into the overall corporate strategy reinforces the premise that sustainability is not only a compliance concern, but is also a crucial element of decision-making processes (Rahat and Nguyen 2024). Companies should use ESG to establish facts, create positive public perception, and strengthen confidence among stakeholders (Luo et al. 2024). The papers presented in this Special Issue advance our understanding of corporate finance and environmental, social, and governance (ESG) practices and offer compelling directions for future study.

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List of Contributions

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Article

Insights into Sustainability Reporting: Trends, Aspects, and Theoretical Perspectives from a Qualitative Lens

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Abstract: This review aims to provide a comprehensive synthesis of the coverage of sustainability reporting (SR) aspects within the corpus of qualitative SR literature. It seeks to elucidate the theoretical and conceptual foundations that have guided the trajectory of the sustainability field and illuminate the qualitative methodologies used in this body of literature. Employing a systematic review methodology, this study undertakes an exhaustive examination of 242 selected empirical studies on sustainability reporting conducted during the period spanning from 2001 to 2022. The noteworthy contribution of this review to the realm of sustainability research lies in its identification of unexplored and underexplored domains that merit attention in forthcoming investigations. These include but are not limited to employee health and safety practices, product responsibility, and gender dynamics. While stakeholder theory and institutional theory have been dominant theories within the selected literature, the exploration of moral legitimacy remains largely underinvestigated. It is essential to underscore that this review exclusively encompasses qualitative studies, owing to the richness and versatility inherent in qualitative research methods. This deliberate selection enables researchers to employ diverse methodological and theoretical frameworks to gain a profound understanding of engagement within the practice of sustainability reporting. This review introduces an interesting approach by considering the thematic scope, as well as theoretical and methodological choices, observed across the selected studies.

Keywords: sustainability reporting; non-financial reporting; systematic review; sustainability accounting; legitimacy theory; stakeholder theory

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1. Introduction

The multitude of environmental, economic, and social crises spanning the last 40 years has precipitated a heightened call for research in the field of SR (Carnegie 2012; Humphrey and Gendron 2015; Unerman and Bennett 2004; Qian et al. 2021). Sustainability reporting (SR) research has gained substantial momentum due to its consequential implications in social, economic, and political domains (Antonini et al. 2020; Cho and Giordano-Spring 2015; Joseph 2012). Originally based on environmental effects (Arunachalam et al. 2016; Birchall et al. 2015; Michelon and Rodrigue 2015), SR expanded rapidly to cover multiple areas. One such pioneering step in this regard is the triple bottom line (TBL), which advocates for the incorporation of planet, people, and profit as focal themes for achieving comprehensive and transparent reporting practices (Javed et al. 2021; Dumay et al. 2016).

Accordingly, scholars have profited from these three dimensions in their works conducted from many perspectives (O'Sullivan and O'Dwyer 2015; Solomon et al. 2011; Williams and Adams 2013). This review aims to offer a perspective on the aspects of sustainability reporting that have been addressed within a designated body of literature and elucidates the qualitative methodologies that have been harnessed to tackle these scholarly inquiries.

Sustainability reporting is driven by the interconnectedness of environmental, social, and economic factors. It encompasses preserving ecosystems, mitigating climate change,

and responsible resource management. Social equity, economic stability, and global collaboration are integral aspects. Prioritizing human health, regulatory adherence, consumer preferences for sustainability, and a focus on long-term viability collectively define the ethos of sustainability, ensuring a resilient and thriving future. However, potential drawbacks include the risk of greenwashing, where organizations may provide misleading information, undermining the credibility of reporting (Hahn and Kühnen 2013). The lack of a universal standard can result in inconsistencies, hindering meaningful comparisons. Selective reporting, resource intensity, and limited stakeholder engagement also pose challenges. A short-term focus and the complexity of reporting may contribute to incomplete or confusing narratives. In essence, while sustainability reporting offers advantages, addressing issues such as greenwashing and improving standardization are crucial in order to maximize its effectiveness (Dunbar et al. 2021). Accordingly, sustainability reporting, despite enhancing transparency, brings inherent risks that can cause reputational damage, legal consequences, financial impacts, and stakeholder discontent. Operational challenges, inconsistency in reporting frameworks, and data security concerns further complicate the landscape. The complexity of reporting can overwhelm organizations, leading to errors (Gray 2006). Mitigating these risks requires careful consideration, adherence to standards, and a commitment to authenticity in reporting (Ioannou and Serafeim 2017). Therefore, while prior reviews have concentrated on diverse aspects such as sustainability performance, measurement, and theoretical frameworks (Chung and Cho 2018); drivers for SR adoption and the quality of reporting (Hahn and Kühnen 2013); different formats and determinants of SR (Dienes et al. 2016); the influence of management control on SR (Traxler et al. 2020); and the extent of integrated reporting (IR), this review distinguishes itself by adopting a unique approach. Rather than focusing exclusively on synthesizing various antecedents or a singular facet of SR, this review aims to investigate sustainability reporting's key themes, aspects, theoretical foundations, and methodological choices. This epistemological emphasis facilitates the coherent formulation of research inquiries within a logical framework, thereby aiding researchers in comprehending the nature and scope of sustainability aspects and guiding their methodological decisions.

In recent years, the landscape of sustainability reporting has witnessed significant regulatory changes. Governments and international bodies have recognized the vital role of transparent reporting in achieving global sustainability goals. These changes include, for instance, the implementation of stricter environmental standards, mandates for corporate social responsibility disclosures, and an emphasis on ethical business practices. This study is motivated by the necessity of analyzing the impact of these regulatory shifts on the methodologies and focus of sustainability reporting research.

Despite the growing body of SR literature, there remain notable gaps that require attention. Prior reviews have concentrated on diverse aspects such as sustainability performance, measurement, and theoretical frameworks (Chung and Cho 2018). However, gaps persist in our understanding of the nuanced interactions between different dimensions of sustainability reporting, the effectiveness of emerging reporting formats, and the integration of sustainability into core business strategies. This study aims to address these gaps by adopting a holistic approach, synthesizing existing knowledge, and identifying avenues for further exploration. Moreover, emerging trends in sustainability reporting, such as the rise of integrated reporting (IR) and the increasing emphasis on social impact metrics, present new challenges and opportunities. This study is driven by a commitment to staying at the forefront of these trends, examining their implications for research methodologies, and contributing insights that can guide future practices.

Furthermore, the ever-expanding scope of sustainability reporting, from its roots in environmental concerns to encompassing diverse dimensions like social responsibility and economic viability, highlights the need for a comprehensive examination. The dynamic nature of sustainability reporting, coupled with recent regulatory changes, gaps in previous research, and emerging trends, underscores the importance of this study. By delving into these aspects, this research aims to provide a comprehensive understanding of the

evolving landscape of sustainability reporting and its implications for academia, businesses, and policy makers and to explore not only what sustainability reporting includes but also why certain themes and aspects have gained prominence over time.

This review takes into consideration only qualitative empirical studies published in peer-reviewed journals. This selective boundary is motivated by several considerations. First, the field of SR is characterized by a plethora of qualitative research methodologies (Adams and Larrinaga-Gonzalez 2019; Parker and Northcott 2016). Secondly, the abundant information inherent in qualitative research incites researchers to use a diverse range of approaches for a deeper and broader comprehension of SR engagement (Parker et al. 2011). Lastly, qualitative research affords the capacity to delve into the processes, contextual differences, and complex dynamics (Parker 2008; Parker 2011). The nature of qualitative research provides an opportunity to closely scrutinize the impact of SR.

The remainder of this paper is organized as follows. In Section 2, we outline the research. Then, we report our findings, covering the aspects of sustainability reporting in the literature, theories used in the literature, and methodologies employed. Tin the final sections of the paper, we delve into a comprehensive discussion of the review findings, provide a conclusion, and suggest avenues for future research.

2. Materials and Methods

The current review employed a systematic review approach to systematically detect, select, and evaluate the most pertinent studies aligned with the objectives of this review as suggested by many scholars in the field (Tranfield et al. 2003). Concerning the concept of sustainability, various terms, such as environmental, social, and governance (ESG) reporting; corporate citizenship, corporate social responsibility (CSR); and social accounting, are often utilized interchangeably (Parker 2008; Gray 2014). Despite the assortment of terminologies in use, all these operational definitions fundamentally share the same essence: the communication of information about an organization's environmental, economic, and social performance to a diverse array of stakeholders. Another relatively recent trend in reporting is integrated reporting (IR), wherein both financial and non-financial forms of information are presented in a unified format. The non-financial facet of IR is the primary focal point of sustainability research (Gleeson-White 2014).

The various terms used in the literature to define the diverse conceptualizations and applications of SR discussed above (CSR, social accounting, corporate citizenship, ESG reporting, integrated reporting, GRI, TBL, and sustainability) were incorporated into the search string used during the abstract keyword search. To broaden the search on sustainability reporting, the words reporting and disclosure were added to the other terms for possible combinations of terms including "corporate social responsibility", "global reporting initiative", "sustainable development", "sustainability", "triple bottom line", "integrated", "environmental", "corporate citizenship", "GRI", "TBL", "social accounting", "IR", "sustainable development", "environment social governance", and "ESG". To narrow the area of the research, keywords such as "qualitative", "exploratory study", "explanatory study", and "interpretive" were added to the search strings using the Boolean operator "and", limiting the search only to qualitative research.

The search was conducted in April 2023 across four distinguished citation databases: Scopus, Business Source Complete, ProQuest Business, and Web of Science. The selection of these databases adheres to the precedent set by previous systematic reviews in the field (Adams and Larrinaga-Gonzalez 2019; Hinze and Sump 2019) and provided us with a coherent sample of articles. Furthermore, our research is delimited to articles published in the English language during the last two decades (2001–2022). This temporal constraint was imposed because publications with a sustainability focus during the early 2000s had limited and inconsequential impacts. In all databases, approximately 6% of the articles were published between 2001 and 2010. This trend aligns with the observations made by (Tranfield et al. 2003) in their examination of engagement research on corporate social responsibility (CSR). As noted by (Qian et al. 2021; Javed et al. 2021), the most

substantial advancements in sustainability have occurred in the past two decades. Therefore, the exclusion of research published before 2001 is adequate to review the body of literature on sustainability reporting (SR).

The consolidation of all articles in one list yielded a total of 852 articles. These articles underwent another elimination round to select the empirical studies, i.e., those grounded in experiences, real-life observations, phenomena, and empirical evidence. Consequently, articles categorized as reviews, prescriptive or descriptive pieces, commentary, or general discussions were determined to be non-empirical and excluded from the sample. Moreover, articles that did not primarily center on non-financial disclosures or sustainability were also excluded. Finally, duplicate papers in these four databases were eliminated, a total of 14 articles using mixed methods were added to the corpus for review, and the selection process resulted in a total of 242 articles for further review and investigation of theoretical frameworks and methodologies employed. Figure 1 shows the article selection process.

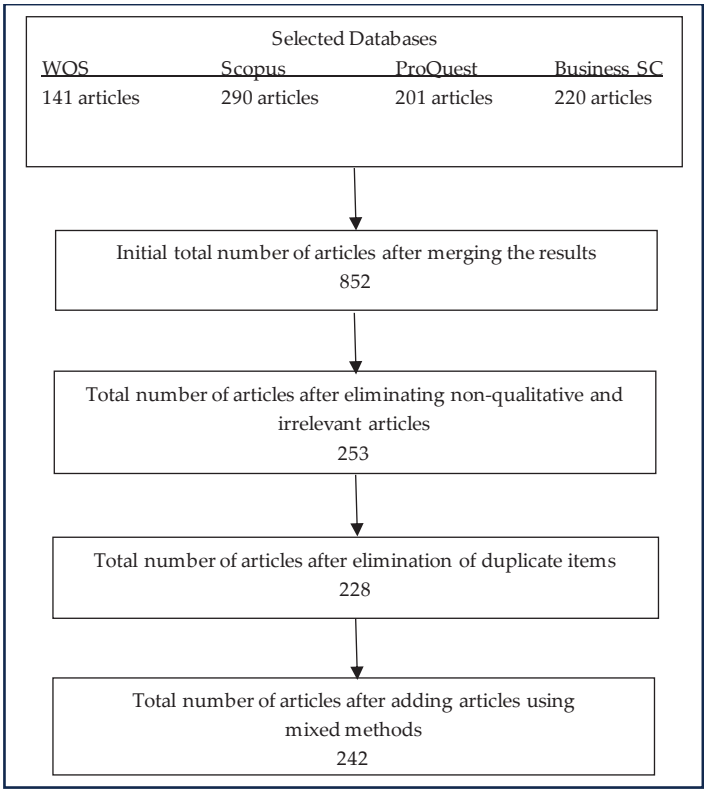

Figure 1. Article selection process.

Accordingly, the aspects of sustainability reporting empirically explored in the selected literature, qualitative methodologies, and theoretical frameworks are the focus of this systematic review. By addressing these points, this review contributes substantive insights into the contemporary trends and diverse sustainability dimensions. Moreover, it offers guidance with respect to areas warranting further attention, benefiting practitioners and regulators by highlighting the domains where heightened practical and regulatory arrangements are needed (Dumay et al. 2016).

3. Descriptive Analysis

The systematic review procedure resulted in the identification of a total of 242 articles. These articles underwent a subsequent screening phase to elucidate their findings. Initially, all articles were classified based on the disciplinary focus of the journals in which they were published. These focus areas included sustainability, finance, accounting, economics, and management. Further analysis provided a descriptive overview of sustainability reporting publications according to journal focus.

Among the chosen articles, 33% (80) were published in journals that prioritize social and environmental accounting, such as "Sustainability". Conversely, 32% (78) of the articles appeared in journals focused on accounting and related fields. This highlights the notable involvement of accounting scholars in advancing research on sustainability. Furthermore, other journals concentrating on business and management have also made substantial contributions to the development of sustainability research.

The descriptive analysis categorized the studies into two broad economic groups: developed and developing economies. This analysis revealed that 64% (155) of the studies were conducted with a focus on developed European economies. Conversely, a relatively smaller portion of empirical studies, totaling 31% (75), focused on emerging economies.

This focus on sustainability reporting in the research can be attributed to well-established and stringent regulatory frameworks in place in these countries. These regulations may mandate or encourage businesses to disclose information related to their environmental, social, and governance (ESG) practices. Moreover, developed economies generally have higher levels of awareness and adherence to corporate governance standards. As sustainability reporting is often linked to broader corporate governance practices, researchers may find more data and interest in this area within these economies.

Investors and stakeholders in developed and European economies exhibit a higher demand for sustainability-related information. This demand is driven by factors such as socially responsible investing, ethical consumerism, and pressure from advocacy groups.

Additionally, researchers may find it more feasible to conduct studies in developed economies due to better access to resources, data, and information. Developed nations typically have more established research institutions, databases, and networks that facilitate comprehensive studies on sustainability reporting. Researchers may prioritize studying these economies to understand and potentially shape global trends in sustainability reporting. Finally, developed and European economies have often been at the forefront of adopting sustainability reporting practices. The maturity of these practices provides a rich ground for researchers to analyze the evolution, effectiveness, and impact of sustainability reporting over time. While there is a predominant focus on developed and European economies, it is essential for future research to broaden its scope to include emerging markets and developing economies. This expansion would contribute to a more comprehensive understanding of the global landscape of sustainability reporting and address the need for inclusive and diverse perspectives.

3.1. Description of Aspects of Qualitative Sustainability Reporting

Sustainability has garnered substantial attention within organizations since the beginning of the millennium, driven by global recognition of the enduring impact of business activities on both current and future generations (Bebbington and Unerman 2018). Consequently, the United Nations introduced a comprehensive definition of sustainability, stating that any decision that "meets the needs of the present without compromising the ability of future generations to meet their own needs" qualifies as a sustainable decision or action. Since the publication of this report, the concept of sustainability has expanded to encompass social, environmental, and economic dimensions significantly influenced by human decisions. At the organizational level, Elkington (Elkington 2004) developed the triple bottom line (TBL) framework, which is grounded in seven drivers of sustainability progress. The TBL concept offers valuable guidance and principles for defining environmental, social, and economic responsibilities within organizations (Gimenez et al. 2012;

Rambaud and Richard 2015). The TBL concept encompasses the social, environmental, and economic interactions of an organization (Gray 2014).

The triple bottom line (TBL) approach offers organizations a comprehensive and well-organized framework for the implementation, reporting, and disclosure of various sustainability practices. One notable development stemming from the TBL is the people, planet, and profit (3Ps) reporting framework. The widespread acceptance of the TBL is shown by its adoption as a reference model by the Global Reporting Initiative (GRI). Existing research literature supports the notion that the GRI is recognized as the most rigorous guideline for sustainability reporting (SR) (Boiral 2013) and has become the standard framework for SR (Bananuka et al. 2019; Bananuka et al. 2022; Petcharat and Zaman 2019). The GRI's classification of broader sustainability dimensions into specific categories and subcategories has brought precision to the focus of academic research, enabling researchers to contribute to specific sustainability dimensions. Accordingly, the review shows that researchers followed the TBL approach and that the environment (planet) was the frame used in 25% (60) of the selected literature, with a general focus on climate change, carbon accounting, water management, and biodiversity. The social (people) frame was used in 17% (41) of the articles, with a focus on employees, employee reporting, and social disclosures. Finally, the economic (profit) frame was used in 10% (24) of the works, taking into consideration mostly the tax issues related to sustainability and CSR. Other works (48%) were based on multiple aspects of sustainability reporting.

3.2. Main Theoretical Frameworks in the Literature

A theoretical framework is the lens through which researchers view, explain, and comprehend reality (Anfara and Mertz 2014). It forms the foundation for a researcher's methodological choices. Consequently, different theoretical perspectives exist to explain sustainability reporting (SR) as either an organizational change process or a stakeholder management process. The primary theoretical frameworks in the selected articles were legitimacy theory (LT), stakeholder theory (ST), and institutional theory (IT).

The following section depicts the three important theories used in the selected literature.

3.2.1. Stakeholder Theory

SR encompasses many groups, extending beyond just funding providers (Gray 2006). In the context of SR, stakeholders are "Entities, associations, and individuals that could be affected by the actions and decisions of the reporting organization. Stakeholders include employees, workers, suppliers, the community, activists, institutional investors, and civil society organizations" (Gray 2006).

The complexity and dynamism associated with the identification of diverse stakeholders deal with five distinct organization–stakeholder relationships in environmental reporting: demanding, promoting, committing, donating, and preventing (Gray 2006; Onkila et al. 2014). Stakeholder theory facilitates communication between organizations and stakeholders through four facets: descriptive, instrumental, normative, and managerial aspects.

3.2.2. Legitimacy Theory

This theory posits that an organization aligns its actions with socially desirable "norms, values, beliefs, and definitions" (Suchman 1995). Suchman (1995) affirmed that organizations seek legitimacy through pragmatic, moral, and cognitive rationales. This review synthesized the selected literature according to these three rationales. A considerable number of articles (36 articles, constituting 15%) employed LT as a foundational framework. Table 1 shows the main theories and related approaches in the literature.

Table 1. Main theories and related approaches in the literature.

Theory	Main Theoretical Approaches	Research Subjects	Examples from the Selected Literature
Stakeholder Theory	Descriptive Instrumental	Current stakeholder management situation and needs	(Michelon and Rodrigue 2015)
	Normative Managerial	Stakeholder management framing and management issues	(Antonini et al. 2020; Belal et al. 2015) (Finau et al. 2018; Onkila et al. 2014)
Legitimacy Theory	Pragmatic	Relationships with third parties and the community	(Killian and O'Regan 2016; Morrison and Lowe 2021)
	Moral	Communication	
	Cognitive	Logistics and other system improvements for sustainability	(Javed et al. 2021)
Institutional Theory	Coercive Mimetic	Regulations and governments Corporate performance measurement	(Cho and Giordano-Spring 2015; Chung and Cho 2018; Tranfield et al. 2003)
	Normative	Accounting bodies, professions, and standards	(Qian et al. 2021; Fraser 2012; Qian et al. 2011)
Others	Socio-political	Employees, reforms, regulations, and mixed subjects	(Biondi et al. 2020; Tanima et al. 2020)

3.2.3. Institutional Theory

The escalating trend in sustainability reporting as a response to economic pressures is a subject of debate. Hahn and Kühnen (2013) showed mixed empirical findings regarding economic pressure as a determinant of SR. However, they also showed that social and cultural pressures may push organizations to adopt SR. Accordingly, organizations institutionalize specific sustainability norms, values, and beliefs in their operations. This institutionalization is often characterized by isomorphism, encompassing coercive, mimetic, and normative isomorphism, leading to a homogenization of organizational practices (DiMaggio and Powell 1983).

3.3. Methodological Approaches in Qualitative Sustainability Reporting Research

Researchers employ various qualitative research methods in their sustainability studies, often selecting the approach based on their specific research areas (Creswell and Poth 2017). Utilizing Suddaby and Greenwood's (2008) methodological framework for examining institutional change, this review concentrates on three distinct techniques: interpretive, historical, and dialectical techniques. The multivariate methodology was excluded from consideration, as the review aimed to synthesize and identify gaps specifically in qualitative methodologies within SR research.

The interpretive approach involves a detailed examination of stakeholders' perceptions and interpretations of institutional practices and structures (Suddaby and Greenwood 2008). It seeks to uncover how and why structural changes emerge. This approach employs content analysis, case studies, investigation of documents and websites, a semiotic lens, and interviews to shed light on the intention and progress of sustainability reporting, stakeholders' perception, stakeholders' framing, and SR's performance and institutionalization. The articles using this methodology accounted for 75% (180) of the selected literature, and the leading articles using this methodological framework are (e.g., Boiral 2013; Gray 2014; Dillard and Pullman 2017; Tanima et al. 2020; Cuckston 2013; Tweedie and Martinov-Bennie 2015).

The historical approach considers institutions as outcomes of multiple phenomena influenced by many interacting causes (Brennan and Merkl-Davies 2014; Al Mahameed et al. 2020). This approach aims to determine various stages of change in organizations using historical data and phenomena to explain institutional and organizational arrangements. This approach is mainly based on document analysis and seeks historical evidence of

tensions in current SR practices. Many scholars (e.g., Albu et al. 2020; Khan and Ali 2023; Khan 2014) used this methodology in the selected literature.

The dialectical approach adopts a critical perspective, assuming that organizations are formed by power relations in society (Al-Htaybat and von Alberti-Alhtaybat 2018). It delves into the influence of power dynamics on the formation and evolution of institutions. The articles in the sample using this approach deal with power and politics, carbon accounting, climate issues, and stakeholder management at times of crisis (e.g., Albu et al. 2020; Belal et al. 2015; Bowen and Wittneben 2011). They account for 15% (36) of the sample. Other works can be classified as using mixed methodologies.

4. Discussion

This study sought to offer an overview of the extent to which sustainability aspects are investigated within a chosen body of qualitative literature. The theoretical approaches used in sustainability research, the qualitative research methods utilized within the literature, and major aspects in this line of research were examined. In the following section, we examine the findings and their significance.

4.1. Sustainability Reporting Aspects

The review reveals that among the three dimensions of sustainability (environmental, social, and economic), the environmental dimension is the most extensively studied in the selected literature. Topics within the environmental dimension include climate change and carbon accounting (Boiral 2013), stakeholder influence in environmental standard setting, water accounting and management, and biodiversity governance and valuation (Gray 2006; Suddaby and Greenwood 2008). This heightened focus is likely a response to the increasing urgency to address environmental degradation and align business practices with sustainability goals. Conversely, the social and economic dimensions have received relatively less attention, although recent studies indicate a growing trend in these areas. For instance, social aspects explored in recent literature include community engagement in local environmental policy making, responsible investment decisions, social risk assessment related to the supply chain, and workplace community-focused CSR disclosure. Economic aspects include the institutionalization of ESG issues in investment decisions, sustainable product design, and the reconceptualization of multiple capitals (Ashraf and Uddin 2015; Ramya et al. 2020).

Additionally, the review shows that a significant portion of the literature (50%, 121) views sustainability reporting as a concept incorporating all three dimensions. Sustainability reporting is viewed as a multifaceted instrument for organizational management and communication, serving the dual purposes of stakeholder engagement and legitimization. This approach aligns with the evolving expectations of stakeholders who seek comprehensive insights into organizational sustainability practices. Sustainability reporting is not merely a disclosure tool but is increasingly recognized as a strategic instrument for organizational management and communication. The integration of ethical concerns further emphasizes the need for companies to showcase their commitment to responsible and ethical business practices (Jámbor and Zanócz 2023).

Recent studies, particularly those published after 2018, reveal a shift from an institutional perspective to a social–political paradigm. Contextualization, particularly in emerging economies, has become a prominent trend in SR research. This shift underscores SR's global significance and the importance of fostering a shared understanding of the subject (Journeault et al. 2021). This shift indicates a broader recognition that sustainability reporting is not solely an institutional practice but is deeply embedded in societal and political contexts. Contextualization reflects a growing awareness of diverse global perspectives and the need for nuanced, culturally relevant approaches to sustainability.

However, certain areas remain underexplored in recent literature. Indigenous people's rights, despite UN emphasis on this issue, have received limited attention, with only a single article shedding light on this topic (Prinsloo and Maroun 2020; Scandurra and Thomas 2023;

Richard and Odendaal 2021). Moreover, there is a requirement for additional investigation in domains like employee health and safety measures, product responsibility, and gender dynamics. Addressing these gaps is crucial for a more inclusive and comprehensive understanding of the social implications of sustainability reporting.

A deep dive into these findings highlights both the progress and the existing gaps in sustainability reporting research. Emphasizing the holistic nature of sustainability, understanding contextual influences, and addressing underexplored areas will contribute to a more robust and impactful sustainability reporting framework. Researchers and practitioners can use these insights to guide future studies, ensuring that sustainability reporting continues to evolve in tandem with global challenges and societal expectations.

4.2. Theories in Selected Literature

This review identified the prevalent theories used in exploring various aspects of sustainability reporting (SR). There are two major theories used in the selected works: stakeholder theory (ST) and legitimacy theory (LT), which are used as fundamental theories in qualitative SR research.

Approximately 33% (81) of the selected articles employed ST as a primary theoretical framework for their empirical investigations. ST is applied to elucidate how organizations perceive and interact with diverse stakeholder groups. The literature identifies a wide array of stakeholder groups, including social activists, employees, vulnerable societies, investors, suppliers, and indigenous people. For instance, Herremans and Nazari (2016), Belal et al. (2015), and Del Baldo (2017) raised questions about how world trade should embrace environmental responsibility, emphasizing the role of vulnerable societies. Khan and Ali (2023), Erin et al. (2022), and Esteban-Arrea and Garcia-Torea (2022) focused on information disclosure about employees' rights. Finau et al. (2018) view stakeholder relationships as network peripherals, highlighting stakeholders' efforts to gain power within organizations. The findings suggest that sustainability reporting is considered a tool for communicating sustainability practices to stakeholders, aligning with its instrumental aspect. The findings also acknowledge the complex and dynamic nature of organization–stakeholder interactions, resonating with sustainability reporting.

Legitimacy theory is widely used in the literature. Among studies using LT, the pragmatic aspect is most prevalent, accounting for 87%. The pragmatic perspective interprets actions taken by organizations to address immediate stakeholders. Fraser (2012) and Killian and O'Regan (2016) describe social accounting as a pragmatic legitimacy practice employed by organizations to rebuild relationships with their communities.

In summary, ST and LT are prominent theoretical frameworks employed in the selected literature to explore various facets and tensions of SR. ST emphasizes stakeholder interactions and relationships, while LT focuses on organizational efforts to maintain legitimacy through SR practices. These theories provide valuable insights, contributing to our understanding of how organizations perceive and respond to sustainability challenges and stakeholder expectations.

This review also uncovers the usage of various aspects of the major theories in the selected literature, shedding light on how the structures and practices of organizations change according to different pressures and influences. These aspects include moral legitimacy, institutional theory (IT), and other critical and interdisciplinary perspectives.

Moral legitimacy suggests that organizations undertake actions deemed ethically sound. Despite its alignment with the core purpose of sustainability reporting (SR), this facet has received limited attention in qualitative sustainability research. This review of existing literature underscores the significance of moral legitimacy as an underdeveloped dimension within the realm of sustainability reporting. Institutional theory, specifically coercive, mimetic, and normative pressures, plays a significant role in shaping organizational practices related to SR. Coercive pressures arise from regulatory sources, both formal and informal, and encompass internal and external factors of an organization. This review also shows that crises, whether instigated by human actions or natural events, can im-

pose sustainability disclosure (Doni et al. 2019). Organizations also feel mimetic pressures. They tend to imitate benchmarked organizations' SR practices to avoid risks associated with imposing extensive regulatory reporting requirements. There are also normative pressures that stem from professional bodies, especially accounting and auditing bodies (Cooper and Pearce 2011; Khan 2014; Haigh and Shapiro 2012). While less prevalent compared to coercive and mimetic pressures, normative pressures play a role in shaping organizational change related to SR, such as reporting frameworks, membership in sustainability rating bodies, and independent auditors (Dillard and Pullman 2017; Moerman and Laan 2015).

The review findings highlight the co-existence of these three forces of institutionalization, emphasizing their complex and multifaceted nature. Institutionalization is seen as a progressive and recursive process, with changes in practice and structure more than in underlying values and beliefs. Additionally, greenwashing practices, where companies may not genuinely adopt sustainability practices despite outward appearances, are also captured in the findings (Tarquinio and Xhindole 2022; Henriques et al. 2022; Cho 2020). Other important aspects of SR captured in the review include the impact of neoliberal economic ideologies (Albertini 2019; Abernathy et al. 2017) and socio-political factors (Tanima et al. 2020; Leong and Hazelton 2017) on sustainability reporting. The role of regulatory theory (Biondi et al. 2020) in shaping sustainability reporting practices and diffusion theory (Stefanescua et al. 2016) is to examine how SR practices spread and diffuse across organizations and regions (Siddiqui 2013).

The emerging use of mainstream accounting theories such as signaling theory (Alotaibi and Hussainey 2016) and agency theory (Stefanescua et al. 2016; Jensen and Meckling 1976) in the context of sustainability reporting is also noted. The diversity of theoretical frameworks reflects the complex nature of sustainability reporting and the interdisciplinary nature of research in this field.

4.3. Qualitative Methods Used in the Selected Literature

Concerning the qualitative methodologies used in the selected literature, the results show that a significant majority of the selected articles (78%) utilized interpretive analysis research methodologies such as case analysis (Cuckston 2013; Egan 2014; Qian et al. 2011), content analysis (Aribi and Gao 2010; Fonseca 2010; García-Sánchez and Araújo-Bernardo 2020), discourse analysis (Higgins and Coffey 2016; Higgins and Walker 2012; Jaworska 2018), and historical analysis (Albu et al. 2020; Khan 2014).

Among these methodologies, case studies provide rich insights into how and why SR practices change (Traxler et al. 2020). They offer a detailed examination of specific instances of SR in practice. Content analysis uses textual data, such as reports and documents, to extract meaning and patterns related to SR.

Only a small percentage of studies (1%) used historical analysis and archival data as their qualitative methodology. This method involves examining historical records and archival data to understand the history and evolution of SR practices. While less common, a few studies employed netnography, a methodology that uses Internet sources and online communities to capture information and debates related to SR (Jeacle 2021; Unerman and Bennett 2004).

A significant portion of the selected studies (17%) employed discourse analysis to explore how power, politics, and conflicts among powerful actors influence organizational change, examining the language and communication surrounding SR (Tregidga 2013; Lodhia and Jacobs 2013) and shedding light on the discursive aspects of sustainability reporting.

The findings of this review indicate that the authors of numerous studies regarded shifts in organizational sustainability as a manifestation of power struggles and conflict management. Semi-structured interviews were frequently employed to unveil the existence of these power dynamics, politics, and conflicts between various stakeholders within organizations (Biondi et al. 2020; Morrison and Lowe 2021; Cook and Geldenhuys 2018). Additionally, the review revealed that the presence of these dynamics at every level in an organization can shape SR practices. This review also identified an emerging trend accord-

ing to which sustainability researchers are increasingly adopting a critical theory paradigm. Critical theories are used to problematize social issues arising from SR practices and to advocate for more equitable and meaningful reporting. Critical theory is a philosophical and sociological approach to studying society, culture, and various social phenomena. It emerged as a response to traditional modes of social inquiry and seeks to critique and transform social structures and systems of power. Critical theory has influenced various fields, including sociology, political science, cultural studies, and education, contributing to ongoing discussions about social justice and societal change.

5. Implications and Conclusions

In this review, first, the choice of databases aligns with the precedent set by previous systematic reviews. The aim of this selection was to provide a coherent sample of articles, enhancing the robustness and comprehensiveness of the review. Secondly, the emphasis on developed European economies is justified by their well-established regulatory frameworks and higher levels of awareness regarding corporate governance standards. Third, the inclusion of various theoretical frameworks reflects the multifaceted nature of sustainability reporting. Accordingly, the acknowledgment of emerging theories, such as critical theory, demonstrates a commitment to exploring diverse perspectives to understand sustainability reporting practices.

The review findings have both theoretical and methodological implications for future research in the field of SR. According to the review findings, it can be argued that there is a need for more empirical research to explain the nature of changes in sustainability reporting practices in today's organizations. This emphasis on empirical studies ensures that the findings are grounded in real-life observations and experiences, enhancing the reliability and applicability of the insights. It also necessitates additional investigation into the descriptive dimension of stakeholder theory, with a focus on highlighting the role of organizations as collaborative partners in their interactions with stakeholders (e.g., Jaworska 2018; Tweedie and Martinov-Bennie 2015). ST and LT are prominent theoretical frameworks employed in the selected literature to explore various facets and tensions of SR. ST emphasizes stakeholder interactions and relationships, while LT focuses on organizational efforts to maintain legitimacy through SR practices. These theories provide valuable insights, contributing to our understanding of how organizations perceive and respond to sustainability challenges and stakeholder expectations. ST provides a comprehensive and flexible framework for researchers to examine the complex interplay between organizations and their broader social, economic, and environmental contexts. It fosters a more inclusive and socially responsible approach to management and decision making. Legitimacy theory is a valuable lens for researchers interested in the dynamics of organizational legitimacy, how organizations respond to societal expectations, and the implications of perceived legitimacy for organizational success and sustainability. Accordingly, these two theories are dominant in SR research. The emerging trend of the use of critical theory is also an important result of this review. This diversity encourages researchers to approach the topic from different perspectives, fostering a more holistic understanding.

The results of this review emphasize the crucial need for a diversified approach, encompassing both methodological and theoretical perspectives, to advance sustainability reporting (SR). The findings highlight the potential applicability of organizational change theories in unexplored dimensions, contributing to the evolving landscape of SR research. Overall, the conclusion advocates for innovative approaches, gap exploration, and an interdisciplinary perspective to capture the diverse and profound impacts of sustainability reporting. It should also be added that sustainability reporting is generally considered a positive practice, offering transparency and accountability by providing stakeholders with insights into a company's environmental, social, and economic performance. It fosters informed decision making among stakeholders, encouraging support for socially and environmentally responsible businesses. Additionally, sustainability reporting signals a commitment to corporate responsibility, motivating organizations to adopt more sus-

tainable practices. However, its effectiveness depends on factors such as the sincerity of reporting, stakeholder understanding, and the commitment of organizations to genuine sustainability initiatives. Challenges include the risk of "greenwashing", where reported information may be misleading; the potential complexity of reporting requirements for smaller businesses; and the trade-off between reporting efforts and actual sustainability actions. Despite these considerations, when approached with integrity and a genuine commitment to sustainability, reporting can be a valuable tool for fostering transparency, accountability, and responsible business practices.

In conclusion, this review provides a comprehensive overview of the aspects, theories, and methodologies used in qualitative research on sustainability reporting. It identifies gaps and opportunities for future research to advance knowledge in the field of SR, emphasizing the need for interdisciplinary and critical perspectives to understand the multifaceted nature of sustainability reporting practices.

This review offers actionable insights for diverse stakeholders. Policymakers can leverage the findings to shape policies aligned with evolving industry practices, while companies can enhance their sustainability reporting based on practical implications and emerging trends identified in the research. Moreover, collaboration across disciplines is encouraged to promote a holistic understanding of sustainability reporting. Advocacy groups and investors can use this research to advocate for ethical reporting standards. Given the emphasis on ethical concerns in sustainability reporting, regulatory frameworks could consider incorporating specific guidelines or standards that address ethical dimensions. Additionally, organizations and policy makers can engage with global initiatives like the Global Reporting Initiative for consistent and recognized sustainability reporting practices. This review highlights that the environmental dimension is the most extensively studied in sustainability reporting. Regulatory bodies could encourage a more balanced approach by placing greater emphasis on the social and economic dimensions. Moreover, regulatory frameworks could encourage research in underexplored areas in sustainability reporting, such as indigenous people's rights and specific domains like employee health and safety measures, possibly by including specific indicators or disclosure requirements related to these aspects. This review also highlights the growing importance of SR in various disciplines and encourages further interdisciplinary exploration of its impacts. The exploration of unconventional applications of organizational change, like institutional logic and deinstitutionalization, opens new paths for future research. This review suggests the need for more qualitative research that explores the ethical aspects of SR, with moral legitimacy as a potential theoretical framework.

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The Impact of Environmental Accounting Information Disclosure on Financial Risk: The Case of Listed Companies in the Vietnam Stock Market

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Abstract: This research study aims to assess the impact of environmental accounting information disclosure on financial risk within the context of Vietnam's stock market. The data collection process involved 60 non-financial companies, carefully selected from both the pool of 100 Sustainable Companies listed in the "Programme on Benchmarking and Announcing Sustainable Companies in Vietnam (CSI)", as organized by VBCSD, and companies outside this list. The data span a timeframe from 2018 to 2022. Afterward, we utilize regression models to assess relationships and employ the *t*-test to evaluate differences. The results indicate that environmental accounting information disclosure has an inverse effect on the financial risk of the current year and the following year. This implies that companies that are more transparent and proactive in reporting their environmental performance are likely to experience decreased financial risk. Furthermore, the results also show differences in financial risk between the group of companies within the "100 Sustainable Companies" list and the group of companies outside this list. This disparity underscores the potential financial benefits of being recognized as a sustainable company. Based on the findings, the research team has provided several recommendations to enhance environmental accounting information disclosure and awareness.

Keywords: environmental accounting; environmental accounting information disclosure; financial risk; sustainable companies; CSI

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1. Introduction

In recent years, issues related to sustainable development, economic development in parallel with social progress, and ensuring environmental sustainability have become significant global concerns. In this context, environmental accounting has emerged to support businesses in fulfilling their environmental responsibilities during their production and operations. Essentially, environmental accounting seeks and provides essential information on environmental-related issues, aiming to enhance the accountability of businesses in their use of resources. In addition, environmental accounting is also a part of accounting aimed at recording, analyzing, and reporting information about a company's impacts on the environment.

Information disclosure has become an indispensable part of public companies, as stakeholders use it to assess the business's performance. Although there is no unified definition of environmental accounting, according to the International Federation of Accountants (IFAC), environmental accounting is a broad term with many implications, such as assessing and disclosing environmental information combined with financial information in accounting and financial reporting. From this, it can be seen that environmental accounting disclosure includes, first, general environmental information: presenting environmental

policies, describing environmental issues the company may face, improvements the company has implemented, and the level of compliance with legally mandated protective measures; second, environmental accounting information: displaying business activities related to the environment such as assets, costs, liabilities, and environmental income in accounting reports such as financial statements and annual reports for information users, providing a basis for making relevant decisions. This will allow companies to allocate economic resources more reasonably in line with the environment to provide motivation to help the business achieve sustainable development goals. Vietnam is in a period of international economic integration, the disclosure of environmental accounting information and non-financial information is also a trend that Vietnam needs to embrace quickly. However, in practice, not many companies can provide a comprehensive set of environmental information to stakeholders (Linh 2013). When information for stakeholders is not adequately provided, it can pose risks for the company, such as reducing opportunities for collaboration and issues related to environmental legal compliance. Financial risks are risks arising from external environmental fluctuations and risks stemming from the choices and implementation of financial decisions within a business. These risks impact the profit-making capability and solvency of the business, with the worst-case scenario leading to the possibility of business bankruptcy. Pham and Duong (2022) conducted a study on the impact of disclosing information about environmental impacts on the financial performance of listed companies in Vietnam during the period 2016–2020. The research results showed that the extent of disclosing information about environmental impacts has a positive effect on the financial performance of companies. This is because the disclosure of environmental accounting information helps the business strengthen the trust of various stakeholders. Therefore, the lack of this information can have a negative impact on financial risk management within the company. So, it can be observed that there is a linkage between the disclosure of environmental accounting information and financial risks within a company. Therefore, the authors have chosen the topic "The Impact of Environmental Accounting Information Disclosure on Financial Risk: The Case of Listed Companies in the Vietnam Stock Market" for research. We particularly focus on companies participating in the "Programme on Benchmarking and Announcing Sustainable Companies in Vietnam (CSI)". The research questions encompass how the disclosure of environmental accounting information affects the financial risk of businesses; and whether there is a difference in financial risk between the group of companies listed in the Top 100 Sustainable Companies and the group outside this list. After the research process, the main findings indicate that disclosing environmental accounting information helps mitigate the financial risks of businesses in the current year and the following year. Additionally, companies listed in the Top 100 Sustainable Companies have, on average, lower financial risks compared to those outside the list. From these findings, the authors propose several recommendations aimed at assisting businesses in enhancing the quality of environmental accounting information disclosure and minimizing financial risks.

This research aspires to make contributions to the theoretical understanding of social responsibility information disclosure and the financial performance of businesses. This study could serve as a foundation for future in-depth research on environmental accounting and social responsibility, as well as related issues. Moreover, this research holds practical significance in exploring the relationship between environmental issues and the financial performance of businesses, providing valuable insights for managers in developing enterprises in an era focused on green and sustainable development.

This study aims to achieve the following specific objectives: firstly, examine the factors influencing financial risks; secondly, investigate how environmental accounting information disclosure affects financial risks, positively or negatively, in the current year for non-financial companies listed on the Vietnam Stock Market; thirdly, explore the relationship between environmental accounting information disclosure and the financial risks of companies in the following year; fourthly, study the differences in financial risks among companies implementing environmental accounting information disclosure within differ-

ent target groups as categorized by the research team; fifthly, provide recommendations to improve financial risks, financial risk management, and the quality of environmental accounting information disclosure for companies.

To address these objectives, the research team has designed research questions to find answers to: Question 1: What factors influence financial risk? Question 2: How does environmental accounting information disclosure impact financial risk in the current year? Question 3: How does environmental accounting information disclosure affect financial risk in the following year? Question 4: Are there differences in financial risk between the group of companies recognized as "Sustainable Enterprises in Vietnam" and the remaining group of companies? Question 5: What recommendations should be made to help companies improve financial risks, financial risk management, and the quality of environmental accounting information disclosure?

2. Literature Review and Theoretical Framework

2.1. Literature Review

Environmental accounting has garnered significant attention from both academia and business practitioners in developed nations. Official guidelines on environmental accounting were established by the United Nations Sustainable Development Commission (UNDSD) in 2001 and the International Federation of Accountants (IFAC) in 2005. Despite this, research in environmental accounting dates back to the 1970s, with a surge in studies and literature emerging in the 1990s. The period from 1997 to the present is particularly notable for a boom in environmental accounting research, covering theoretical aspects, accounting practices, and the impact of environmental accounting and social responsibility on financial risks. This field has become a focal point for scientific inquiry, attracting increasing interest from researchers.

Regarding the examination of the impact of environmental accounting disclosure in general and social responsibility on corporate risk, previous studies have predominantly identified an inverse relationship between the disclosure of environmental and social information and corporate risk (Liu and Lu 2021; Eriandani and Wijaya 2021; Cai et al. 2016; Jo and Na 2012; Minor and Morgan 2011; Luo and Bhattacharya 2009; Godfrey et al. 2009; Orlitzky and Benjamin 2001).

The study by Liu and Lu (2021) focused on all publicly traded companies in Standard and Poor's Compustat from 2004 to 2012, scoring social responsibility disclosure in aspects such as the environment, community, and corporate governance. The research results showed that companies with higher disclosure scores had significantly lower corporate risk. Additionally, the results implied that social responsibility disclosure partly reduces risk through the company's reputation.

The study by Eriandani and Wijaya (2021) sampled listed companies on the Indonesia Stock Exchange that disclosed social responsibility information from 2016 to 2019. It demonstrated that disclosure activities had an inverse relationship with corporate risk, as such activities could build reputation and enable effective resource management. Companies could minimize risk by disclosing social responsibility information as a way to demonstrate a balance between economic, social, and environmental aspects.

The study by Cai et al. (2016) examined the relationship between environmental responsibility and a company's risk. To test hypotheses related to risk reduction, resource constraints, and industry variations, the authors collected a sample comprising 1947 large U.S. companies from the period between 2003 and 2015 by combining various datasets. The research results indicated that companies with environmental responsibility may face lower risks.

The discussion on studies examining the impact of environmental accounting disclosure in general and social responsibility on the risk of bankruptcy or financial distress is significant. Do (2022) conducted a study to explore the relationship between corporate social responsibility and bankruptcy risk, with a focus on conditional effects over different time periods. The results revealed an inverse relationship between social responsibility and

bankruptcy risk. Furthermore, the long-term impact of social responsibility was stronger than the short-term effect.

Boubaker et al. (2020) investigated how corporate social responsibility affects the level of financial distress risk. The study sample consisted of 1201 publicly listed companies in the United States from 1991 to 2012. The research results indicated that companies with high-quality social responsibility have lower levels of financial distress risk and a better ability to access financial resources, aligned with the conclusion, the diversity of community, employee relationships, and environmental aspects of corporate social responsibility helps reduce financial distress risk for businesses (Attig et al. 2013).

The study by Cooper and Uzun (2019) utilized a sample comprising 78 companies that filed for bankruptcy during the period from 2007 to 2014 and a corresponding group of companies that did not. Overall, the results indicated that companies with higher levels of social responsibility disclosure are less likely to face bankruptcy compared to companies with lower disclosure levels.

The research conducted by Lin and Dong (2018) aimed to address the question of whether the financial distress of companies could be mitigated through a commitment to social responsibility. The study's findings demonstrated that companies with a positive history of engaging in social responsibility were less likely to file for bankruptcy when facing financial difficulties and were more likely to recover quickly after a crisis.

Additionally, some studies have highlighted an inverse relationship between social responsibility and systemic risk by increasing the disclosure of social responsibility, which helps enhance financial efficiency and reduce capital costs (El Ghoul et al. 2011; Oikonomou et al. 2012).

Ding et al. (2022) investigated the role of environmental information disclosure in relation to borrowing costs. This study focused on manufacturing companies that had been penalized by the Chinese government for violating environmental rules and regulations. Based on the results, the authors found that regulatory penalties significantly increased a company's borrowing costs in the following year through the adverse impact of environmental information disclosure.

The study by Albuquerque et al. (2019) presented an industry equilibrium model in which companies have the choice to engage in social responsibility activities as an investment to enhance product differentiation, allowing them to benefit from higher profit margins. The research aims to capture the social, environmental, and corporate governance factors related to a company's operations, financial performance, and risk management. The research results indicate that social responsibility activities affect a company's systemic risk. Companies that disclose information on social responsibility will have lower capital costs, and investors including these companies' stocks in their investment portfolios will help reduce the overall portfolio risk.

Dutta and Nezlobin (2017) used data from companies in the S&P 500 to confirm that social responsibility has an inverse impact on systemic risk, which includes market risk. The study also indicated that companies with higher social responsibility tend to have lower capital costs. The research results further revealed that, all else being equal, current shareholders prefer maximum information disclosure, and the future benefits to shareholders will increase (decrease) depending on the accuracy of the disclosed information if the company's growth rate is above (below) a certain threshold.

Research on the impact of environmental accounting and environmental information disclosure has gained popularity in developed countries where the relationship between business activities and the environment has been recognized for an extended period. Environmental accounting is relatively new in Vietnam and primarily follows the general provisions of Circular 96/2020/TT-BTC or the Global Reporting Initiative (GRI) framework for implementation. In Vietnam, studies on corporate social responsibility and environmental accounting have only been conducted in recent years and have not been significantly practical. A few recent studies in this context include (Nguyen 2020, 2022; Nguyen et al. 2022, 2023; Anh-Tuan et al. 2022). In general, research in this field in Vietnam is not yet

diverse across various aspects and has not delved deeply into specific relationships. Additionally, the results of these studies may differ due to different national contexts and various time periods. Therefore, our research team embarks on this study with the intention of investigating and collecting information to fill the gaps in this field in Vietnam.

2.2. Theoretical Background

To assess the level of environmental accounting information disclosure and its relationship with financial risk, we utilize the following theories:

The theory of legitimacy posits that organizations must align their activities with societal values and standards. Failure to adhere to these social values and standards can lead to difficulties in gaining community support for their continued operation. The theory of legitimacy originates from the research on legitimacy in politics by the German economist and sociologist Weber (1922) in his work "Concepts in Sociology". Given the increasing societal concern about the environment, the public expects that organizations will exhibit responsible and environmentally-friendly behavior. Failing to meet these societal expectations and demands could result in sanctions, such as the revocation of licenses, which can have long-term implications for the survival of the business (Deegan 2002). This theory explains the motivation behind using environmental accounting as a tool to fulfill social responsibility and ensure legal compliance. Therefore, the clearer the disclosure of environmental accounting information, the more it minimizes legal and ethical issues, reducing financial risks.

Since its introduction, Resource Dependency Theory has become one of the most influential theories in organizational and strategic management. This theory emerged from the idea of organizations' vulnerability to their external environment (Pfeffer and Salancik 1978). This theory asserts that organizations must recognize and identify the societal groups upon which they depend. They must then manage and align their actions and behaviors with the needs of these external societal groups to reduce the risks and potential reactions from them. Bhattacharyya (2016) applied this theory to examine the extent of environmental information disclosure. According to this framework, businesses need to secure support and consensus from society, especially from the entities that provide the primary resources to the organization. Therefore, disclosing environmental accounting information becomes a necessary and appropriate action aligned with societal demands, reducing the risks associated with external societal reactions and minimizing financial risks for the company.

The stakeholder theory originated from Freeman's (1984) research on organizational management and business ethics. This theory asserts that organizations have an obligation to treat their stakeholders fairly. The concept of accountability (information disclosure) requires businesses to be responsible for their activities. The responsibility to account for actions to stakeholders extends beyond that of accountability to shareholders. As the success of businesses depends on how they balance the diverse needs of stakeholders, enterprises need to respond and account for stakeholders. Freeman and Liedtka (1997) identified three reasons for accountability to stakeholders: (i) interest-based accountability; (ii) rights-based accountability; (iii) obligation-based accountability. Ullmann (1985) developed a conceptual model of corporate social responsibility. Ullmann concluded that the stakeholder theory provides a suitable framework for integrating strategic decisions into the examination of corporate social responsibility activities. Manini et al. (2016) used this theory to analyze the correlation between financial structure, company profitability, audit firm type, liquidity, the number of years in business, and environmental information disclosure. A company's operations have an impact on both internal and external stakeholders. This theory is employed to explain why companies voluntarily adopt environmental accounting information disclosure to meet the increasing demand for environmental data from various stakeholders, including government agencies, credit organizations, investors, consumers, and the community. Conversely, the lack of transparent disclosure of environmental accounting information can lead to specific financial risks for the company.

2.3. Research Hypotheses

2.3.1. The Relationship between the Level of Environmental Accounting Information Disclosure and Financial Risk

Elias (2004) argues that businesses are facing increasing pressure from stakeholders to establish ethics and transparent information systems. Today's market economy demands that companies not only sell products and services but also create value and fulfill corporate social responsibility (CSR) towards the public. Regarding the relationship between CSR and business risks, various studies have found evidence supporting the beneficial impact of engaging in CSR on business risks from different perspectives (Cheung 2016; Albuquerque et al. 2019). Companies with higher CSR effectiveness tend to be perceived as less risky by investors. According to the stakeholder theory, for a business to sustain and thrive, it needs to balance the interests of various stakeholders, such as shareholders, employees, and customers (Freeman 1984; Mishra and Modi 2013). CSR activities can help companies mitigate the risk of losing support from one or more stakeholders, enhancing the reputation of these companies. Strong relationships with stakeholders can improve the ability to reduce risk by reducing market uncertainty, thus eliminating or mitigating any disruptions, losses, or damages to a company's profits and minimizing the impact of unforeseen events (Kytle and Ruggie 2005).

With efforts to improve the financial market in Vietnam, the disclosure of information related to social responsibility is gradually becoming a near-obligatory element in annual reports, as emphasized in Circular 96/2020/TT-BTC, affirming the concern of stakeholders on this matter. Therefore, it can be seen that the disclosure of environmental accounting information has an impact on the financial risks of companies, hence the research hypothesis (H1) is formulated as follows:

H1a. *The level of environmental accounting information disclosure has an inverse effect on the financial risk of the company in the current year.*

H1b. *The level of environmental accounting information disclosure has an inverse effect on the financial risk of the company in the following year.*

2.3.2. Assessing the Differences in Financial Risk between Listed Companies Included in the List of the Top 100 Sustainable Companies in Vietnam and Those Not on This List

According to the stakeholder theory, businesses should address the interests of all stakeholders rather than just their own. Freeman (1984) noted that when there is consensus among stakeholders, interests are enhanced, and cooperation is promoted. Therefore, many businesses have adopted various strategies to encourage consensus among stakeholders. In Vietnam, to enhance the trust and satisfaction of stakeholders, many companies have chosen to participate in the "Programme on Benchmarking and Announcing Sustainable Companies in Vietnam (CSI)". The CSI program helps raise awareness among businesses and society about the importance and benefits of sustainable development in the new context, as well as encourages businesses to engage in sustainable business practices and sustainable corporate management. Simultaneously, this recognition also provides businesses with the opportunity to enhance their reputation, brand, and attract human resources. It opens doors to new business opportunities by increasing the trust of partners, investors, and shareholders. It contributes to the development of sustainable business, thereby improving the competitive capabilities of businesses in the current international economic integration context.

With these positive impacts, when recognized among the top 100 companies in the CSI program, the financial risks of these companies are likely to be significantly reduced. Therefore, the research group formulates hypothesis (H2) as follows:

H2. *There is a difference in financial risk between companies listed in the top 100 Sustainable Companies in Vietnam and companies not included in this list.*

3. Research Methodology

3.1. Data Collection

Group 1: Listed companies meeting two criteria: (i) Have published financial reports and annual reports (or sustainability reports) from 2018 to 2022, and (ii) are included in the list of the top 100 Sustainable Companies in the "Programme on Benchmarking and Announcing Sustainable Companies in Vietnam (CSI)" for at least 3 out of 5 years from 2018 to 2022.

Group 2: Listed companies not included in the list of the top 100 Sustainable Companies from 2018 to 2022 but meeting two criteria: (i) Have published financial reports and annual reports (or sustainability reports) from 2018 to 2022, and (ii) have business size and sector corresponding to Group 1.

After screening the list of 100 Sustainable Companies over the course of 5 years, only a total of 30 companies meet the criteria for Group 1. Next, 30 suitable companies for Group 2 companies are selected (both in terms of quantity and quality, matching those of Group 1). The sample comprises 300 observations, in line with the conditions for analysis (Tauchen 1986; Hair et al. 2011). The final research sample is presented in Table 1.

Table 1. Sample allocation by industry.

Industry	Number of Companies	Observations
Manufacturing	42	210
Utilities	8	40
Construction and Real Estate	6	30
Transportation and Warehousing	2	10
Wholesale	2	10
Total	60	300

3.2. Variable Measurements

3.2.1. Dependent Variable: Financial Risk (FR)

In this study, the financial risk measurement model developed by Alexander Bathory (Bathory 1984) is utilized. The formula is as follows:

$$FR_{it} = SZL_{it} + SY_{it} + GL_{it} + YF_{it} + YZ_{it} \quad (1)$$

where

SZL_{it} = (profit before tax + depreciation + deferred tax)/current liabilities.
SY_{it} = pre-tax profit/operating capital.
GL_{it} = shareholders' interests/current liabilities.
YF_{it} = net tangible assets/total liabilities.
YZ_{it} = working capital/total assets.

Bathory's model suggests that a higher value of FRit indicates lower financial risk, and vice versa.

3.2.2. Independent Variable: The Level of Environmental Accounting Disclosure (ENVI)

We calculate the variable ENVI based on the 2016 GRI (Global Reporting Initiative (GRI) 2016) Sustainability Reporting Standards, specifically with the environmental criteria (GRI 300) as presented in Table 2.

Table 2. Environmental items.

No.	Field	Number of Items	Referencing to GRI
1	Materials	4	301
2	Energy	6	302
3	Water	4	303
4	Biodiversity	5	304
5	Emissions	8	305
6	Effluents and Waste	6	306
7	Environmental Compliance	2	307
8	Supplier Environmental Assessment	3	308

Each item is scored depending on the level of environmental accounting disclosure in the annual report (or sustainability report) of the company. The scoring scale is presented in Table 3.

Table 3. The method for assessing the level of environmental information disclosure.

The Level of Information Disclosure	Score
Full disclosure of required information through quantitative data or qualitative information	2
Partial disclosure of required information but not complete	1
Non-disclosure of required content or disclosure of irrelevant information	0

After scoring the items, the score represents the level of environmental accounting information disclosure of the company, calculated according to the formula:

$$ENVI_{it} = \sum X_{nt} \quad (2)$$

where

X_{nt} is the score of item n disclosed by company i in year t.

To illustrate the calculation method of the variable ENVI, we provide an assessment and computation example in Table 4. The company in this example is Vietnam Dairy Products Joint Stock Company (VNM), one of the selected companies in the study sample. The table below presents the evaluation and computation of the level of environmental information disclosure for VNM in the year 2022.

Table 4. Table assessing the level of environmental information disclosure of VNM in 2022.

Item	Content	Score	Item	Content	Score
301-0	Management approach	1	305-0	Management approach	1
301-1	Materials used by weight or volume	0	305-1	Direct (Scope 1) GHG emissions	1
301-2	Recycled input materials used	2	305-2	Energy indirect (Scope 2) GHG emissions	1
301-3	Reclaimed products and their packaging materials	0	305-3	Other indirect (Scope 3) GHG emissions	0
302-0	Management approach	1	305-4	GHG emissions intensity	1
302-1	Energy consumption within the organization	1	305-5	Reduction in GHG emissions	1
302-2	Energy consumption outside of the organization	0	305-6	Emissions of ozone-depleting substances (ODS)	0

Table 4. *Cont.*

Item	Content	Score	Item	Content	Score
302-3	Energy intensity	1	305-7	Nitrogen oxides (NOx), sulfur oxides (SOx), and other significant air emissions	0
302-4	Reduction in energy consumption	2	306-0	Management approach	1
302-5	Reduction in energy requirements of products and services	2	306-1	Water discharge by quality and destination	1
303-0	Management approach	1	306-2	Waste by type and disposal method	2
303-1	Water withdrawal by source	2	306-3	Significant spills	1
303-2	Water sources significantly affected by withdrawal of water	1	306-4	Transport of hazardous waste	1
303-3	Water recycled and reused	1	306-5	Water bodies affected by water discharges and/or runoff	1
304-0	Management approach	1	307-0	Management approach	0
304-1	Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	0	307-1	Non-compliance with environmental laws and regulations	0
304-2	Significant impacts of activities, products, and services on biodiversity	1	308-0	Management approach	1
304-3	Habitats protected or restored	1	308-1	New suppliers that were screened using environmental criteria	2
304-4	IUCN Red List species and national conservation list species with habitats in areas affected by operations	0	308-2	Negative environmental impacts in the supply chain and actions taken	1
Total score (X) = 34					

3.2.3. Control Variables

The control variables include business size (SIZE), financial leverage (LEV), return on assets (ROA), and current ratio (CR) as shown in Table 5.

Table 5. Measurement of control variables.

Code	Control Variable	Measurement	References
SIZE	Business size	Log(Total Assets)	Ohlson (1980); De Jonghe et al. (2015); Al-Hadi et al. (2019)
LEV	Financial leverage	Liabilities/Total Assets	Ayadi et al. (2015); Benlemlih et al. (2018); Al-Hadi et al. (2019)
ROA	Return on assets	(Net Income/Average Total Assets)*100	Altman (1968); Bhunia and Mukhuti (2012); Ahmed Sheikh and Wang (2013); Al-Hadi et al. (2019)
CR	Current ratio	Current Assets/Current Liabilities	Beaver (1966); Edmister (1972); Ohlson (1980); Bhunia and Mukhuti (2012)

Based on theoretical background and previous studies, from constructing hypotheses H1a and H1b, we propose the research model as follows:

$$\mathbf{FR_{it}} = \beta_0 + \beta_1 \mathbf{ENVI_{it}} + \beta_2 \mathbf{SIZE_{it}} + \beta_3 \mathbf{LEV_{it}} + \beta_4 \mathbf{ROA_{it}} + \beta_5 \mathbf{CR_{it}} + \varepsilon_{\mathbf{it}} \quad (3)$$

$$\mathbf{FR_{it}} = \alpha_0 + \alpha_1 \mathbf{ENVI_{it-1}} + \alpha_2 \mathbf{SIZE_{it}} + \alpha_3 \mathbf{LEV_{it}} + \alpha_4 \mathbf{ROA_{it}} + \alpha_5 \mathbf{CR_{it}} + \mathbf{e_{it}} \quad (4)$$

4. Results and Discussion

4.1. Descriptive Statistics

Figure 1 provides an overview of the level of environmental accounting information disclosure by listed companies in Vietnam from 2018 to 2022. The average ENVI index increased over the years, rising from 9.47 in 2018 to 14 in 2022, an increase of 47.89%. This is a positive sign, indicating that Vietnamese companies are becoming more concerned about environmental information disclosure. Especially in the 2021–2022 period, the average index increased more rapidly compared to the previous period. The average index in 2020 increased by 17.25% compared to 2018, from 9.47 to 11.1. Meanwhile, the rate of increase in 2022 compared to 2020 was even higher, at 26.13%, going from 11.1 to 14. This may be due to the issuance and enforcement of Circular 96/2020/TT-BTC, which has increased legal pressure on listed companies and raised awareness of environmental accounting practices and disclosure.

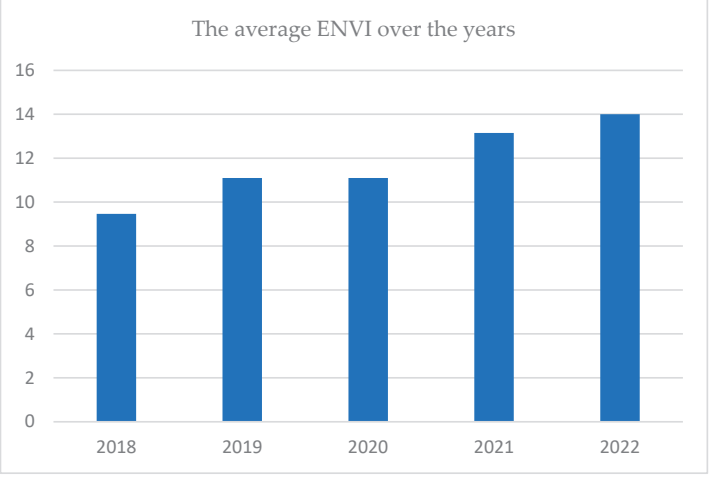

Figure 1. Environmental Information Disclosure Index for the Period 2018–2022.

Table 6 presents descriptive statistics of the variables in the model. Accordingly, FR has an average value of 5.293, ranging from −1.029 to 108.349, with a standard deviation of 7.301, indicating significant variation in financial risk among the companies. ENVI has an average value of 11.763, ranging from 0 to 39, with a standard deviation of 8.843, suggesting that Vietnamese companies, in general, have awareness of environmental accounting, but there is substantial variation among them. SIZE has an average value of 3.485, ranging from 2.297 to 5.411. LEV has an average value of 0.441, ranging from 0.079 to 0.931. ROA has an average value of 8.816, ranging from −1.1 to 47.51. CR has an average value of 2.304, ranging from 0.252 to 10.842.

Table 6. Descriptive statistics of the variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
FR	300	5.293275	7.30096	−1.028936	108.3492
$ENVI_t$	300	11.76333	8.842773	0	39
$ENVI_{t-1}$	240	11.20417	8.701223	0	38
SIZE	300	3.485007	0.5990884	2.296665	5.411173
LEV	300	0.4409413	0.198406	0.079096	0.9310873
ROA	300	8.815633	7.520865	−1.1	47.51
CR	300	2.30426	1.520973	0.252497	10.84211

4.2. Assessing the Correlation between Variables

The correlation matrix and the calculated Variance Inflation Factor (VIF) results are presented in Table 7. It can be observed that the independent variables $ENVI_t$ and $ENVI_{t-1}$ have a positive correlation with the dependent variable FR, with correlation coefficients of 0.057 and 0.0020, respectively. This suggests that a higher level of environmental accounting information disclosure in the previous year and the current year leads to a reduction in financial risk in the present and the future. A higher value of FR indicates lower financial risk (Bathory 1984). However, to confirm the accuracy of these results, a regression analysis should be conducted.

Table 7. Correlation matrix and VIF coefficients.

	FR	$ENVI_t$	$ENVI_{t-1}$	SIZE	LEV	ROA	CR	VIF_t	VIF_{t-1}
FR	1.0000							-	-
$ENVI_t$	0.0565	1.0000						1.25	-
$ENVI_{t-1}$	0.0020	0.8970	1.0000					-	1.24
SIZE	−0.1669	0.3190	0.3188	1.0000				1.28	1.29
LEV	−0.3235	−0.1502	−0.1354	0.2612	1.0000			2.07	2.04
ROA	0.2450	0.2190	0.2094	−0.1863	−0.4675	1.0000		1.35	1.35
CR	0.3298	0.0875	0.0680	−0.1577	−0.6402	0.2960	1.0000	1.70	1.65

Table 7 also shows that the absolute values of the correlation coefficients between independent variables are all less than 0.8, and the VIF coefficients of the variables are also less than 5. Therefore, there is no issue of multicollinearity.

4.3. Research Finding and Discussions

4.3.1. The Relationship between the Level of Environmental Accounting Information Disclosure and the Financial Risk of the Current Year

First, perform regressions using the following models: Ordinary Least Squares (OLS), Fixed-Effects Model (FEM), and Random-Effects Model (REM). Subsequently, we utilize two tests to select the appropriate model. The F-test is used to choose between OLS and FEM, with a p-value of 0.0088 < 0.05 (significant), indicating that the FEM is more appropriate. The Hausman test is employed to select between FEM and REM, and the p-value is 0.5778 > 0.05, suggesting that the REM is a better fit. Therefore, the REM is chosen among the three models. Using Pesaran's test of cross sectional independence yields a p-value of 0.5016, indicating that the model does not encounter the issue of cross-sectional correlation. Next, conduct tests for heteroskedasticity and tests for autocorrelation, with p-values of 0.0119 and 0.0000, both less than 0.05, indicating that the REM suffers from both of these phenomena. To address these issues, perform Feasible Generalized Least Squares (FGLS) estimation. The regression results for the different models are presented in Table 8.

Table 8. Regression results—case without considering lag.

	FR			
	OLS	**FEM**	**REM**	**FGLS**
$ENVI_t$	0.0230811 (0.642)	−0.01655 (0.884)	0.014334 (0.801)	0.0037033 (0.041)
SIZE	−1.144191 (0.124)	−7.334444 (0.108)	−1.189315 (0.181)	−0.5217391 (0.000)
LEV	−4.034508 (0.158)	0.9085111 (0.901)	−3.549392 (0.280)	−4.410638 (0.000)
ROA	0.1046479 (0.086)	0.1090136 (0.450)	0.1083972 (0.121)	0.0785901 (0.000)

Table 8. *Cont.*

	FR			
	OLS	**FEM**	**REM**	**FGLS**
CR	1.010112 (0.003)	1.716255 (0.008)	1.094589 (0.004)	0.9329858 (0.000)
Constant	7.538163 (0.013)	25.73223 (0.094)	7.356697 (0.038)	5.527951 (0.000)
Observations	300	300	300	300
R^2	0.1340	0.0927	0.1482	-

It can be observed that the variable $ENVI_t$ has a *p*-value of 0.041, which is less than 0.05, indicating statistical significance. Additionally, the coefficient $\beta 1 = 0.004$ demonstrates that the variables $ENVI_t$ and FR have a positive relationship. According to Bathory, a higher value of FR indicates lower financial risk. Thus, we conclude that the hypothesis H1a is accepted: The level of environmental accounting information disclosure has an inverse effect on the financial risk of the company in the current year. This result is consistent with previous studies (Cai et al. 2016; Boubaker et al. 2020; Do 2022).

4.3.2. The Relationship between the Level of Environmental Accounting Information Disclosure and the Financial Risk of the Following Year

Conduct regressions using various models: OLS, FEM, and REM. Subsequently, employ two tests to choose the appropriate model. With the F-test, the *p*-value is 0.0000, which is less than 0.05, indicating that the FEM is more suitable. Using the Hausman test, the *p*-value is 0.3364, which is greater than 0.05, suggesting that the REM is more appropriate. Thus, the REM is selected from among the three models. Using the Pesaran test yields a *p*-value of 0.0182, indicating that the model encounters cross-correlation. Next, conduct tests for heteroskedasticity and tests for autocorrelation, with *p*-values of 0.0000 and 0.0004, respectively, both less than 0.05, concluding that the REM is affected by both phenomena. To address these issues, perform FGLS estimation. The regression results for the various models are presented in Table 9.

Table 9. Regression results—case considering lag.

	FR			
	OLS	**FEM**	**REM**	**FGLS**
$ENVI_{t-1}$	−0.0414766 (0.088)	0.0322612 (0.399)	−0.0013598 (0.962)	0.0215336 (0.000)
SIZE	−0.511191 (0.152)	−1.212972 (0.436)	−0.7889314 (0.161)	−1.140958 (0.000)
LEV	−6.725794 (0.000)	−2.706355 (0.300)	−4.719109 (0.007)	−2.385443 (0.000)
ROA	0.1181029 (0.000)	0.0799709 (0.089)	0.0934042 (0.008)	0.0808845 (0.000)
CR	1.005345 (0.000)	1.511309 (0.000)	1.32014 (0.000)	1.435245 (0.000)
Constant	6.814886 (0.000)	5.846111 (0.274)	5.943473 (0.004)	5.394794 (0.000)
Observations	240	240	240	240
R^2	0.5315	0.5020	0.5283	-

With a significance level of 5%, the results indicate that the variable $ENVI_{t-1}$ has a positive relationship with FR, with a coefficient of 0.022. This suggests that as the level of environmental accounting information disclosure increases, the financial risk for the following year decreases. Therefore, we can conclude that hypothesis H1b is accepted: The level of environmental accounting information disclosure has an inverse effect on the financial risk of the company in the following year.

From Table 10, it can be concluded that an increase in the level of disclosure of environmental accounting information helps mitigate the financial risk of the companies in the current year and the following year. For the control variables, both models yield consistent results. As the scale of the companies increases, financial risk may also increase. Companies with high financial leverage may face higher financial risks. A high return on assets can minimize financial risk. Companies with strong current liquidity have lower financial risk.

Table 10. Regression results summary.

	FR		**The Relationship with the Variable FR**	**The Relationship with Financial Risk**
	Non-Lag	**Lag**		
$ENVI_t$	0.0037033	-	+	−
$ENVI_{t-1}$	-	0.0215336	+	−
SIZE	−0.5217391	−1.140958	−	+
LEV	−4.410638	−2.385443	−	+
ROA	0.0785901	0.0808845	+	−
CR	0.9329858	1.435245	+	−

4.3.3. Evaluate the Difference in Financial Risk between Companies Listed in the "Top 100 Sustainable Companies in Vietnam" and Those outside This List

To determine the difference in financial risk between the two groups of companies, the research team used the independent-samples *t*-test. The results are presented in Table 11.

Table 11. Results of the independent-samples *t*-test.

	Group	Obs	Mean	Std. Err.	Std. Dev.	Pr(|T| > |t|)
FR	Non-TOP	178	4.501455	0.3002183	4.005411	0.0230
	TOP	122	6.448553	0.9320428	10.29475	
$ENVI_t$	Non-TOP	178	9.11236	0.483452	6.450048	0.0000
	TOP	122	15.63115	0.93627	10.34144	

The results in the table show that the mean value of FR for the group of companies within the list is 6.449, while for the group outside the list, it is 4.501. Additionally, the *p*-value is 0.0230, which is less than 0.05. Thus, the hypothesis H0 is rejected and accepts the alternative hypothesis. This means that there is a significant difference in financial risk between the companies within the "100 Sustainable Companies in Vietnam" list and those outside the list. This research's hypothesis H2 is accepted.

At the same time, the average value of ENVI for the group of companies within the list is 15.631, while for the group outside the list, it is 9.112. The *p*-value is 0.0000, which is less than 0.05. Therefore, it can be concluded that there is a difference in the level of environmental accounting information disclosure between the two groups.

So, companies within the list tend to disclose more environmental accounting information and have lower average financial risks compared to companies outside the list. This conclusion further supports hypotheses H1a and H1b. It is evident that environmental accounting information disclosure can help companies enhance their image and reputation, especially in the context of increasing community interest in green growth and sustainable development. Good information disclosure can attract investors, retain employees, establish a bond with consumers, and improve relationships with sponsors, local communities, and governments, thereby minimizing financial risks.

5. Conclusions and Policy Implications

This research was conducted with the aim of understanding the relationship between the disclosure of environmental accounting information and the financial risk of businesses, as well as determining the differences in this risk between two groups of companies. The results show that the disclosure of environmental accounting information has an inverse impact on financial risks. This is consistent with previous studies (Cai et al. 2016; Boubaker et al. 2020; Do 2022). Moreover, this research contributes some new points: (1) This study also examines and indicates that the disclosure of environmental accounting information not only affects the current-year financial risk but also helps prevent financial risk in the following year. (2) Companies listed in the top 100 Sustainable Companies tend to disclose more environmental accounting information and have lower financial risks compared to companies outside the list.

Currently, globalization is a powerful phenomenon. Companies engage in activities related to the environment, exploiting resources to achieve the goal of maximizing profit. Therefore, in addition to activities impacting the environment, businesses also need to be concerned about avoiding environmental damage and depleting natural resources. Environmental concerns are not only those of the businesses but also of all stakeholders such as managers, shareholders, and external information users. The disclosure of environmental accounting information is considered a tool to build trust among stakeholders, enhance the credibility and brand of the business in its operational activities, create opportunities for businesses to access global investment sources, and notably, help mitigate financial risks. Based on the research results, discussions, and conclusions presented in the thesis, the research group provides some recommendations to improve and enhance the practical level of environmental accounting and the disclosure of environmental accounting information as follows:

Firstly, establishing a precise and appropriate legal framework for environmental accounting disclosure is crucial in Vietnam. Currently, disclosure in this area is mainly

voluntary, lacking standardized templates. Larger and financially robust companies, as well as certain non-financial enterprises, are more inclined to engage in environmental accounting disclosure, offering more comprehensive information. However, the overall number of reporting enterprises remains low, with some providing only basic and superficial information. Many Vietnamese companies still do not fully grasp the significance of environmental accounting disclosure, prioritizing short-term profits over long-term benefits or company value. Some are unaware or indifferent to the concept, and others exploit legal loopholes, leading to consequences for consumers, the environment, and the economy. The role of state agencies in refining specific legal documents for regulation and management is now more crucial than ever.

Secondly, carry out awareness campaigns through mass media to enhance understanding of environmental accounting information disclosure. Despite gaining attention in Vietnam over the past decade and being adopted by large enterprises, environmental accounting information disclosure is still relatively unfamiliar to small and medium-sized enterprises. Additionally, there is a misconception that focusing on environmental protection activities and transparency in environmental accounting information will incur significant costs and may reduce profitability. Therefore, the government should use continuous communication channels to address concerns, amplify the significance and role of environmental accounting information disclosure. This approach can encourage businesses to improve their practices in environmental accounting information disclosure, making government oversight more straightforward and cohesive.

Thirdly, there is a need to encourage the issuance of evaluation standards, a Code of Conduct for Enterprises. The government should enhance the role of professional associations such as the Chamber of Commerce, the Vietnam Chamber of Commerce and Industry (VCCI), and relevant ministries and sectors in establishing a Code of Conduct and evaluation criteria, providing guidance to enterprises during implementation. Similar to the research, the author's team has selected some enterprises from the list of the "Top 100 Sustainable Companies in Vietnam". These enterprises play an active role and receive enthusiastic support from the business community in implementing the Sustainable Development Strategy in Vietnam. This facilitates the sharing of experiences and best practices, strengthening close coordination and dialogue between the business community, the government, and social partners to promote sustainable development. Annual programs to honor outstanding enterprises in sustainable development serve as both a motivation for businesses and a benchmark for consumers and investors to assess. These programs should be organized more frequently to intensify awareness campaigns, act as a bridge between government agencies and the business sector, and showcase excellent models of sustainable business development.

Fourthly, each enterprise should equip itself with information and gain a deep understanding of environmental accounting disclosure. The research results serve as a basis to encourage organizations to shift their perspectives when preparing annual reports. The content of their annual reports should not only focus on financial indicators and achievements in the current year but should also encompass information on environmental activities. Given the global and Vietnamese trend toward sustainable development, investors increasingly value information related to environmental accounting practices and the corporate social responsibility of enterprises. Therefore, by fulfilling environmental responsibilities, the disclosure of this information to investors and information users, in general, becomes a way to attract their attention and, furthermore, can help reduce the financial risks of the enterprise.

Fifthly, businesses should comply with the regulations and policies of the government, as well as consider adopting global rule sets. In addition to the laws stipulated and strictly enforced by the government, such as environmental protection laws and business laws, there are also globally recognized sets of standards. Notable standards include ISO 26000, ISO 45001, ISO 14000, SA 8000, and many others that cover various aspects including environmental issues. These standards have been widely disseminated globally

and are utilized by numerous businesses worldwide. The benefits for businesses using these standards are diverse, ranging from strengthening and enhancing the quality of their environmental accounting information disclosure to keeping pace with global trends, increasing the globalization and competitiveness of domestic enterprises in the world.

Moreover, the results also indicate that, in addition to the level of environmental accounting disclosure, factors such as the scale of the company, financial leverage, return on assets, and current liquidity also impact the financial risk of the company. Therefore, to mitigate financial risks, companies need to coordinate and pay attention to these factors to achieve the optimal economic growth rate. This will also ensure sustainable development and enhance the company's reputation in the market.

The team has made efforts to accomplish the set objectives; however, limitations still exist. Firstly, this study only confines the measurement of financial risk and four control variables, while there are other factors that could be utilized to examine this relationship. Secondly, the research sample may not be sufficiently representative of all listed companies on the Hanoi Stock Exchange (HNX) and the Ho Chi Minh Stock Exchange (HOSE), and companies in Vietnam as a whole. Additionally, the level of environmental information disclosure in this study also carries a subjective aspect from the authors. Therefore, several topics are proposed for future research, such as expanding the investigation into the impact of environmental accounting information disclosure using different financial risk models; incorporating additional factors beyond the control variables used in this paper, possibly including perception factors. Extending the scope of the survey to ensure representativeness or delving into a specific industry to ensure specialization is also suggested.

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The Effects of Corporate Financial Disclosure on Stock Prices: A Case Study of Korea's Compulsory Preliminary Earnings Announcements

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Abstract: This paper examines the effects of Korea's compulsory preliminary earnings announcements on stock prices using individual corporate financial disclosure data. Korea's compulsory preliminary earnings announcements are similar to the US's fair disclosures in that they are preliminary settlement disclosures. Disclosure regulation aims to prevent insider trading and resolve information asymmetry among investors by promptly disclosing unconfirmed internal settlement information prior to an external audit. The disclosure of such changes in profit or loss is generally expected to affect stock prices. Many studies have analyzed the relationship between accounting profit disclosure and stock prices, but most have focused on the relationship between net profit disclosure and stock price without considering other disclosure information such as sales and operating profit. In addition, previous studies analyzed the information effect of accounting profits based on annual reports, which are based on analysts' predicted values and limited datasets. This study investigates the impact of Korea's compulsory disclosure on stock prices through a multiple regression analysis, considering three types of accounting information, including sales, operating profit, and net profit, based on actual announcement data and daily trading volumes. The effect of corporate financial disclosure might vary with stock market type and industry sector. For this reason, we analyze the relationship between financial disclosure and stock prices for different stock market types and industry sectors. Results show that sales information affected KOSPI-listed companies' stock prices, and operating profit information affected KOSDAQ-listed companies' stock prices. In terms of financial market efficiency, the results show weak-form efficiency for both the KOSPI and KOSDAQ markets in general. However, this implies that there is still information asymmetry in sales information for the KOSPI, which consists of large and valued stocks and is not completely efficient, whereas information asymmetry might occur in operating profit information for the KOSDAQ, which consists of relatively small-to-medium innovative growing companies. In addition, results show that operating profits affect manufacturing industries' stock prices, and that trading volumes significantly impact stock prices for all markets and industries.

Keywords: compulsory disclosure; fair disclosure; preliminary earnings announcement; profit and loss structure change disclosure

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1. Introduction

Many studies have investigated the information effect of annual report accounting profits on stock prices since Beaver (1968). They focused on the impact of compulsory earnings announcements on stock prices to find the relationship between unexpected earnings (net profit minus analyst-predicted net profit) and stock prices. They depended on a small sample size for unexpected earnings because analysts do not report all stocks. In addition, there is debate regarding whether an annual report is informative, because accounting profits can be predicted in the market through provisional settlement disclosure, which is a voluntary fair disclosure.

We investigate the impact of Korea's compulsory preliminary earnings announcements on stock prices using actual disclosure announcement data. Unlike those in the United States, listed corporations in Korea are obliged to immediately disclose changes in profit and loss structure before making their annual reports when major changes in their financial structure occur. Korean firms should immediately disclose changes in their profit and loss structure if any indicators of sales, operating profit, or net profit increase or decrease by 30% or more compared to the same period in the previous year. This regulation was adopted on 24 March 2000 to prevent insider trading and to resolve information asymmetry between investors by promptly disclosing unconfirmed internal settlement information prior to an external audit. After this regulation was adopted, many studies were conducted in Korea regarding the effect of such disclosures of profit and loss changes on stock prices (Jang and Cheon 2003; Sohn and Lee 2005; Lee and Jung 2008; Jeong and Jeong 2014). Some studies showed that accounting information affected stock prices (Jang and Cheon 2003; Sohn and Lee 2005; Jeong and Jeong 2014), but others showed that accounting information did not affect stock prices (Lee and Jung 2008). However, these studies relied only on analysts' forecasts instead of actual data. In addition, they used only net profit information, but not other important accounting information, such as sales and operating profit. This study analyzes the impact of Korean compulsory disclosure on stock prices by considering three types of accounting information (sales, operating profit, and net profit) based on actual announcement data. Moreover, this study analyzes the relationship between disclosure and stock prices using daily trading volumes for different market types and sectors.

This study contributes to the existing literature as follows: First, we overcame the limitations of existing research by analyzing the effect of Korean compulsory disclosure announcements that are provisional, such as fair disclosures, and compulsory, such as annual reports. Second, we comprehensively analyzed and reflected on disclosure effects using actual sales, operating profit, and net profit information instead of unexpected earnings based on analysts' net profit forecasts. Third, we measured the disclosure effect using the change in stock price on the day of disclosure.

The structure of this paper is as follows: Section 2 reviews previous studies; Section 3 describes data used in this study; analysis and results are presented in Section 4; Section 5 provides conclusions and directions for further studies.

2. Literature Review

2.1. Earnings Reports and Stock Prices

Earnings surprises impact stock prices. In the efficient market hypothesis (EMH), as described by Fama (1970), all publicly available information is instantaneously reflected in the stock price; as a result, no investors expect abnormal excess returns in the long run. To verify the well-established EMH, many studies have investigated the information effect of annual report net profit information on stock prices. However, these studies have shown conflicting results. Since Beaver (1968), many studies related to the information effect of accounting profits have been conducted; most analyzed the relationship between unexpected earnings (actual income minus expected income) and stock prices using annual reports (Wilson 1987; Cready and Mynatt 1991; Lobo and Song 1989).

Some studies found that an annual report's unexpected earnings could have an information effect, because investors predict net profit based on analysts' net profit forecasts, showing that unexpected earnings affect stock prices (Wilson 1987; Lobo and Song 1989; Ball and Brown 1968; Busse and Green 2002; Chordia et al. 2005; Chordia et al. 2005). Chordia et al. (2005) analyzed the short-term effect of announcements using intraday returns for 150 NYSE stocks during the calendar years 1996, 1999, and 2002; they found that weak-form efficiency appeared to prevail over intervals from five minutes to one day. Lee and Choi (2009) analyzed a sample of fair disclosures announced from January 2003 to September 2004 using intraday data to verify the effectiveness of real-time information. They showed that stock prices reacted immediately to fair disclosures announced in real time in the Korean stock market, and argued that when there was an intraday disclosure,

the information was fully reflected in the stock price at the end of the day, with no information delay until the next business day. Olibe et al. (2022) found that significant price and trading volume responses accompanied earnings information in the days immediately surrounding earnings announcements.

However, some studies failed to detect such a price response. Cready and Mynatt (1991) examined price and trading responses to the release of annual reports of US companies that had already made preliminary earnings announcements. They found that the price response was insignificantly different from zero for each of the event days examined. Bänziger et al. (2023) found a semi-strong efficient market between earnings announcements of Swiss companies and stock prices, and suggested that pre- and post-announcement abnormal returns were modest and generally not statistically significant. Fink (2021) also found that an earnings surprise did not lead to a full, instantaneous stock price adjustment, but rather to a low, predictable drift.

2.2. Voluntary Fair Disclosure in the U.S. and Compulsory Disclosure in Korea

In the United States, the fair disclosure system was first introduced in October 2000 to establish fair provisional settlement disclosure. A little earlier, in March 2000, Korea introduced the profit and loss structure change, which required companies to immediately disclose any indicators of sales, operating profit, or net profit that increased or decreased by 30% or more compared to the same period in the previous year. The intent in doing so was to prevent insider trading and resolve information asymmetry between investors by promptly disclosing unconfirmed internal settlement information prior to an external audit. Such disclosure of changes in profit and loss was generally expected to affect stock prices.

Heflin et al. (2003) argued that fair disclosure played a role in narrowing the information gap between investors; they found smaller deviations between pre- and post-announcement stock prices. However, Bailey et al. (2003) found no significant change in return volatility after fair disclosure regulation. Ahmed and Schneible (2007) reported limitations, including selective disclosures regarding disclosure details, and companies that chose whether or not to disclose; however, the information gap between investors had been largely resolved by the introduction of fair disclosure. Sidhu et al. (2008) reported a negative aspect, that inaccurate information might be provided to the market as companies became more arbitrary in their disclosure process.

Since the adoption of compulsory disclosure in Korea, many studies have shown that fair disclosure has information effects (Jang and Cheon 2003; Lee and Choi 2009; Jeong and Jeong 2014; Kim 2018). Some studies have found that accounting information affected stock prices (Jang and Cheon 2003; Sohn and Lee 2005; Jeong and Jeong 2014; Sohn et al. 2015; Lee 2020). Sohn and Lee (2005) showed a relationship between unexpected net profit and stock price using analysts' forecasts. Lee and Choi (2009) analyzed a sample of fair disclosures announced from January 2003 to September 2004 using intraday data to verify the effectiveness of real-time information. They showed that stock prices immediately reacted to fair disclosures announced in real time in the Korean stock market, and argued that when there was an intraday disclosure, the information was fully reflected in the stock price at the end of the day, and that there was no information delay until the next business day. However, Lee and Jung (2008) found no relationship between unexpected net profit and stock price when they used analysts' forecasts; this implies that researchers need to analyze the relationship between net profit and stock price based on actual data instead of analysts' forecasts.

These controversial results motivated us to examine the following questions: Why were the results different? Why did researchers rely on only net profit information to find the relationship between disclosure information and stock price? Why did they use analysts' forecast information instead of using actual data? Thus, we tried to fill the gaps left by the limitations of previous studies and investigated how the disclosure of profit and loss structure changes affected stock prices for different market types and sectors.

3. Materials and Methods

3.1. Data Description

We used web crawling to collect disclosure information from the Korea Exchange's electronic disclosure system (KIND) for January to March 2021 for listed corporations on the KOSPI and the KOSDAQ that disclosed changes in their profit and loss structure. There are approximately 800 companies listed on the KOSPI and approximately 1400 companies listed on the KOSDAQ; approximately 80% of these companies disclose changes in profit and loss structure at the beginning of each year. We obtained 932 records from 2139 disclosures after removing 556 corrective disclosures and 652 records of non-numerical information regarding surplus and deficit conversion. Sohn et al. (2015) analyzed corrective announcements and reported that they have no information effect, so we excluded them from the sample.

3.2. Methodology

We used the following regression model to investigate how disclosure information regarding profit and loss structure changes affected stock prices for different market types and market sectors.

$$\mathrm{AR} = b_0 + b_1\mathrm{SR} + b_2\mathrm{OPR} + b_3\mathrm{NPR} + b_4\mathrm{VR} + \mathrm{e}$$

Table 1 describes the regression model's independent and dependent variables.

Table 1. Variables description.

No	Category	Variable Symbols	Description	References
1	Dependent variable	Abnormal returns (AR)	$R_{it} - R_{mt} = \frac{P_{it}-P_{it-1}}{P_{it-1}} - \sum_{i=1}^{n}(\frac{p_{it}-p_{it-1}}{p_{it-1}})/n$	Sohn and Lee (2005), Chordia et al. (2005), Kim (2018), Gregoire and Martineau (2022), Bänziger et al. (2023)
2	Independent variable	Change rate of sales (SR)	$\frac{SR_{it}-SR_{it-1}}{SR_{it-1}}$ where t is the year, and binned from -5 to 5	Lee and Yoo (2012), Kim (2021)
3	Independent variable	Change rate of operating profit (OPR)	$\frac{OPR_{it}-OPR_{it-1}}{OPR_{it-1}}$ where t is the year, and binned from -5 to 5	Hue and Yoo (2009), Kang and Choi (2014), Kim (2021)
4	Independent variable	Change rate of net profit (NPR)	$\frac{NPR_{it}-NPR_{it-1}}{NPR_{it-1}}$ where t is the year, and binned from -5 to 5	Beaver et al. (1979), Kothari (2001), Bradshaw et al. (2012), Kim (2018), Gregoire and Martineau (2022)
5	Independent variable	Change rate of volume (VR)	$\frac{\ln(VR_{it})-\ln(VR_{it-1})}{\ln(VR_{it-1})}$ where t is the day	Westerfield (1977), Epps (1977), Gallant et al. (1992), An et al. (2006), Jeong and Jeong (2014), Choi (2019), Park (2021)

We used a dependent variable as the abnormal returns by subtracting the average stock price change rate of the sector to which each company belonged from the individual company's stock price change rate (Sohn and Lee 2005; Chordia et al. 2005; Kim 2018; Gregoire and Martineau 2022; Bänziger et al. 2023). Thus, abnormal returns were denoted by

$$AR_{it} = R_{it} - R_{mt}$$

Here, $R_{it} = \frac{P_{it}-P_{it-1}}{P_{it-1}}$, where P_{it} is the individual stock price and P_{it-1} is the stock price of the previous day, and $R_{mt} = \sum_{i=1}^{n}(\frac{p_{it}-p_{it-1}}{p_{it-1}})/n$, where m is the market sector to which each company belongs, and n is the total number of firms in the market sector. We used three disclosures as independent variables: percentage change in sales, percentage change in profit, and percentage change in net profit. We divided each of these three independent variables into 10 bins because the linear relationship between excess returns and unexpected

earnings diminishes when the numerical volatility of unexpected earnings is high (Beaver et al. 1979; Kothari 2001; Kimbrough 2005; Khan and Watts 2009; Kim 2018). Thus, if the percentage change in sales, profit, and net profit increased by 30% or less year-over-year, we categorized it as 1; a 30–60% change in sales, profit, and net profit was categorized as 2; a 60–90% change was categorized as 3; 90–120% as 4; and 120% or more as 5. We categorized decreases the same way, as −1, −2, −3, −4, and −5, respectively; altogether we formed 10 bins, from −5 to 5. In addition, we considered the volume change rate as an independent variable because it played a role in investors' decisions and has been positively related to price changes (Park 2021; Choi 2019; Jeong and Jeong 2014; An et al. 2006; Westerfield 1977; Epps 1977; Gallant et al. 1992). Park (2021) found that an abnormal increase in the trading volume of an individual stock had a significant positive (+) relationship with the stock's excess return. Gallant et al. (1992) suggested that it is effective to simultaneously consider various data, including trading volume, for a more accurate stock price prediction. Therefore, we obtained the volume change rate using the logarithm of the volume on the disclosure day minus the logarithm of the volume on the day before disclosure day, which is $\frac{\ln(VR_{it}) - \ln(VR_{it-1})}{\ln(VR_{it-1})}$.

Next, we examined the effect of disclosure information for two markets (the KOSPI and the KOSDAQ) because different markets might react differently to disclosures (Grant 1980). The KOSPI market is composed of large-cap stocks that have been listed for a long time. There is much information available for large companies in the market, and there might be less unexpected information at the time when earnings are actually disclosed (Atiase 1985). However, the KOSDAQ market is composed of small- and mid-cap stocks that have been listed for a relatively short period of time. We also examined whether the effect of disclosure information differed between manufacturing and non-manufacturing firms, because existing studies mainly analyzed manufacturing firms.

4. Results

4.1. Descriptive Statistics

Prior to empirical analysis, the descriptive statistics of variables used in this study were confirmed. The values of independent and dependent variables are shown in Table 2. Table 2 indicates that the overall accounting profit, trading volume, and stock price increased above the market average because averages of sales, operating profit, net profit, and volume change were all positive on the date of changes in profit and loss disclosure.

Table 2. Descriptive statistics.

	Sales	Profit	Net Profit	Volume	AR
Count	932	932	932	932	932
Mean	0.21	0.42	0.39	0.22	0.09
Std	1.47	2.69	3.06	0.80	3.05
Min	−4.00	−5.00	−5.00	−3.02	−9.84
25%	−1.00	−2.00	−2.00	−0.25	−1.59
50%	1.00	1.00	1.00	0.15	−0.06
75%	1.00	2.00	3.00	0.63	1.56
Max	5.00	5.00	5.00	3.52	16.80

4.2. Correlation Analysis

Table 3 shows correlation analysis results; there was a significant positive correlation among variables. In particular, trading volume was closely related to returns and stock prices. Among the financial disclosure information, operating profit was the most highly correlated with abnormal returns, followed by net profit and sales.

Table 3. Correlation analysis.

	Sales	Profit	Net Profit	Volume	AR
Sales	1	0.447 *	0.321 *	0.100 *	0.096 *
Profit	0.447 *	1	0.640 *	0.149 *	0.141 *
Net Profit	0.321 *	0.640 *	1	0.117 *	0.118 *
Volume	0.100 *	0.149 *	0.117 *	1	0.368 *
AR	0.096 *	0.141 *	0.118 *	0.368 *	1

* denotes 1% significance with *p*-value less than 0.01.

4.3. Results of the Market Model

A regression analysis for each of the KOSPI and KOSDAQ markets was conducted to investigate the influence of three types of financial disclosure information and trading volume on the stock price. We used the following regression model to investigate how compulsory disclosure information affected stock prices for different market types as follows:

$$AR_i = b_0 + b_1SR_i + b_2OPR_i + b_3NPR_i + b_4VR_i + e$$

where i represents KOSPI and KOSDAQ market types.

Table 4 shows regression analysis results with four factors as independent variables and the stock price change as the dependent variable.

Table 4. Regression analysis results for market models.

Variables		Market		
		KOSPI	KOSDAQ	Total
Intercept	Coefficient	−0.232	−0.628	−0.533
	t-Value (Sig.)	−0.106 (0.916)	−0.348 (0.728)	−0.380 (0.704)
Change rate of sales (SR)	Coefficient	0.359	−0.146	0.051
	t-Value (Sig.)	3.171 * (0.002)	−1.614 (0.107)	0.722 (0.470)
Change rate of operating profit (OPR)	Coefficient	−0.012	0.123	0.065
	t-Value (Sig.)	−0.161 (0.872)	2.009 ** (0.045)	1.356 (0.175)
Change rate of net profit (NPR)	Coefficient	0.066	0.008	0.033
	t-Value (Sig.)	0.984 (0.326)	0.172 (0.863)	0.823 (0.411)
Change rate of volume (VR)	Coefficient	1.357	1.285	1.340
	t-Value (Sig.)	8.711 * (0.000)	7.227 * (0.000)	11.463 * (0.000)
Adj. R^2		0.208	0.096	0.140
Obs.		367	565	932

* and ** denote 1% and 5% significance, respectively.

Table 4 shows that there are no significant variables for total sum of KOSDAQ and KOSPI data, except trading volume, which had a 1% significance level. However, sales and trading volume variables were found to have 1% statistical significance for the KOSPI market data, and operating profit variable had 5% significance and trading volume had 1% statistical significance for the KOSDAQ market data. These results are interesting because previous studies considered only net profit as a significant variable. Our results show that sales and operating profit affect stock prices more than net profit does. Kim (2021) showed that changes in the performance of a company's main operating activities had a more significant impact on stock price fluctuations than non-operating activities did.

Furthermore, Kim (2021) said that change rate of operating profit affected stock prices of startup companies which was established 10 years or less ago, whereas change rate of sales affected stock prices of somewhat established companies which are 11 to 30 years old, which supported our results that sales affected KOSPI stock prices and operating profits affected KOSDAQ stock prices. Our results are consistent with those of Grant (1980) and Atiase (1985), who found that stock price reactions to accounting earnings varied across markets. The results also show that trading volume had a significant impact on stock prices regardless of KOSPI or KOSDAQ market type. This implies that market participants consider trading volume as well as sales and operating profit, because stock prices tends to rise when trading volume increased on announcement day compared to the day before the announcement.

4.4. Results of the Sector Model

Regression analysis was conducted for the two sectors to investigate the influence of three types of financial information and volume on the stock price. We also used the following regression model for different sectors:

$$\mathrm{AR}_i = b_0 + b_1\mathrm{SR}_i + b_2\mathrm{OPR}_i + b_3\mathrm{NPR}_i + b_4\mathrm{VR}_i + \mathrm{e}$$

where i represents manufacturing and non-manufacturing market sectors.

Table 5 shows the results of regression analysis for the sector model that operating profit affects manufacturing firms' stock prices at a 10% significance, whereas no accounting profit affects non-manufacturing firms' stock prices. Additionally, trading volume affects stock prices of both manufacturing and non-manufacturing industries at 1% significance.

Table 5. Regression results for sector models.

Variables		Sector	
		Manufacturing	**Non-Manufacturing**
Intercept	Coefficient	−0.352	−0.980
	t-Value (Sig.)	−0.194 (0.846)	−0.408 (0.683)
Change rate of sales (SR)	Coefficient	0.059	0.054
	t-Value (Sig.)	0.623 (0.533)	0.468 (0.641)
Change rate of operating profit (OPR)	Coefficient	0.111	−0.014
	t-Value (Sig.)	1.740 *** (0.082)	−0.183 (0.855)
Change rate of net profit (NPR)	Coefficient	−0.004	0.093
	t-Value (Sig.)	−0.072 (0.942)	1.398 (0.163)
Change rate of volume (VR)	Coefficient	1.372	1.285
	t-Value (Sig.)	9.362 * (0.000)	1.319 * (0.000)
Adj. R^2		0.153	0.120
Obs.		577	287

* and *** denote 1% and 10% significance, respectively.

5. Conclusions

This paper examined the effects of Korea's compulsory preliminary profit and loss disclosure on stock prices using individual corporate financial profit and loss disclosure data. The effect of corporate financial disclosure might vary by stock market type and

industry sector; therefore, we analyzed the relationship between financial disclosure and stock prices for different types of stock markets and industry sectors.

The results of this study are as follows: First, the results indicate that the stock markets generally had weak-form efficiency. However, the results also show that sales information affected KOSPI-listed companies' stock prices and that operating profit information affected KOSDAQ-listed companies' stock prices. Second, operating profit information affected manufacturing industries' stock prices, whereas any accounting information did not affect non-manufacturing industries' stock prices. Third, trading volumes significantly impacted stock prices regardless of market type or industry, which implies that market participants were concerned about trading volumes. Thus, the results indicate that there was room for investors to profit from the possibility of market inefficiency.

However, this study was limited in that we did not analyze unquantified data such as operating profit turnover or net profit turnover information; therefore, these data types were excluded. For future studies, we need to find a way to quantify operating profit turnover and net profit turnover information to comprehensively analyze the disclosure announcement effect.

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Does Capital Expenditure Matter for ESG Disclosure? A UK Perspective

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Abstract: This study examines how capital expenditure (capex) affects Environmental, Social, and Governance (ESG) reporting and how corporate governance moderates this effect. We use data from non-financial firms in the FTSE All Share index from 2012 to 2021 and measure ESG disclosure with the Bloomberg ESG Disclosure Score, capex with logarithm of the ratio of capital expenditure to total assets, and corporate governance with a composite index based on Board Size, Independent Board, Board Diversity, and Audit Committee Non-Executives. We also examine the non-linear and threshold effects of capex on ESG disclosure with spline regression models. We find that capex is positively linked to ESG disclosure and that this association is robust for firms with better corporate governance. Our findings imply that capex improves ESG performance and impact and that corporate governance enables ESG communication to stakeholders. Our research advances the existing literature by revealing the link between capex, governance, and ESG reporting in a dynamic and uncertain environment. Our study holds practical significance for companies, investors, and regulators who want to incorporate ESG factors into capex decisions and reporting.

Keywords: capital expenditure; ESG disclosure; stakeholder theory; resource dependence theory; principal component analysis

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1. Introduction

Environmental, Social, and Governance (ESG) reporting pertains to the disclosure of non-financial data related to a firm's sustainability performance and its influence on diverse stakeholders (Moussa 2023). ESG reporting provides a comprehensive overview of a firm's achievement across environmental, social, and governance aspects. It covers topics such as energy efficiencies, carbon footprints, greenhouse gas emissions, biodiversity, waste management, labor standards, workplace diversity, human rights, talent management, community relations, privacy, and health and safety, as well as governance factors like board composition, sustainability oversight, executive compensation, political contributions, lobbying, and corruption (Bergman et al. 2020). The importance of ESG reporting has grown as stakeholders demand greater transparency and accountability from companies regarding their social and environmental responsibilities and risks. ESG disclosure can also significantly affect a company's financial performance and value (American Institute of CPAs & Center for Audit Quality 2021). Depending on the rules, ESG disclosure can be voluntary or mandatory and involves costs. However, ESG disclosure can also provide valuable information to stakeholders such as investors, customers, employees, regulators, and society and help firms create a better work culture, build trust, and improve their image (Ng and Rezaee 2015). Capital expenditure (capex) is one of the strategic factors that can influence a company's ESG disclosure practices. Capex denotes the amount of money that a company allocates to purchase or enhance fixed assets. It can also have significant social and environmental impacts and risks (Bergman et al. 2020).

The interaction between capex and ESG disclosure is complex and dynamic, as it can affected by a multitude of drivers, such as stakeholder expectations and pressures, regulatory policies and standards, industry characteristics and norms, and corporate governance practices and quality. Despite the significance of this relationship, there is a scarcity of research on the subject, particularly in the UK, where ESG reporting practices and expectations may vary considerably from other developed markets. As such, there is a pressing need for further research into the association between capex and ESG reporting in the UK, where ESG disclosure is less prevalent and often voluntary. This study investigates how capex affects ESG disclosure and how governance moderates this effect in the UK. Using a novel dataset of non-financial firms in the FTSE All Share index from 2012 to 2021, this study measures ESG disclosure with the Bloomberg ESG Disclosure Score, employs an instrumental variable approach to address endogeneity, and exploits an event that occurred in the UK during the study period. This study also examines the non-linearities and thresholds in the capex–ESG disclosure relationship using spline regression models. This is the first study to explore this complex and dynamic relationship in the UK, where ESG disclosure practices and expectations may differ from other developed markets.

The aim of this study is to tackle this deficiency by exploring how capex affects ESG disclosure and how corporate governance moderates this effect in the UK context. This study draws on two main theories to explain the link between capex and ESG disclosure: Stakeholder theory and Resource Dependence theory. Stakeholder theory (Freeman 1984; Donaldson and Preston 1995; Mitchell et al. 1997) advocates for firms to take into account the concerns and anticipations of a wide range of stakeholders, extending beyond just shareholders to encompass customers, employees, suppliers, regulators, and society at large. By investing in capex that shows their commitment to innovation and growth, firms can improve their reputation and legitimacy among their stakeholders, which may induce them to disclose more ESG information. Resource Dependence theory (Pfeffer and Salancik 1978; Hillman et al. 2009) suggests that firms invest in capex to acquire and maintain valuable resources that enable them to survive and thrive. By doing so, they can improve their efficiency, quality, and differentiation, which can increase their market share and profitability. However, capex can also create new ESG risks and opportunities for firms that may require new disclosures.

This study uses a multivariate analysis to test the hypotheses, using a sample of 3294 observations for ESG Disclosure Level and 3995 observations for Capex. This study uses an instrumental variable approach to address endogeneity concerns in the association between capex and ESG reporting, using the 2008 SEO deregulation as an exogenous event that affected capex decisions but not ESG disclosure decisions of firms. This study also uses spline regression models to test for non-linearities and thresholds in the association between capex and ESG reporting.

This study makes a distinctive contribution to the existing literature by providing fresh insights into the association amongst capital expenditure (capex), governance practices, and Environmental, Social, and Governance (ESG) disclosure within the context of the United Kingdom. It advances our understanding of how these elements intersect and impact each other, shedding light on the intricate dynamics at play. Furthermore, this research holds significant practical relevance for corporations, investors, and regulatory bodies. It furnishes guidance on the integration of ESG considerations into capital expenditure decision-making processes and offers strategies for effective communication of ESG performance and impact to diverse stakeholders. The findings of this study facilitate more informed decision making and enhance transparency in ESG-related practices. This paper is organized into six sections. The Section 2 reviews the relevant literature and develops the hypotheses to be tested. The Section 3 describes the data and the methodology used to collect and analyze the data. The Section 4 reports the empirical results of the study. The Section 5 discusses the findings of the study and their implications. The Section 6 concludes the paper by summarizing the main points and providing suggestions for future research.

2. Literature Review, Theoretical Framework, and Hypothesis Development

2.1. Literature Review

The association between capex and ESG disclosure is complex and dynamic, as it can be affected by various aspects, including stakeholder expectations and pressures, regulatory policies and standards, industry characteristics and norms, and corporate governance practices and quality. Environmental, Social, and Governance (ESG) disclosure refers to the voluntary or mandatory reporting of non-financial information on a company's sustainability performance and impact on various stakeholders, such as investors, customers, employees, suppliers, regulators, and society at large. ESG disclosure has become increasingly important in the corporate world, as stakeholders demand more transparency and accountability from companies regarding their social and environmental responsibility and risks. ESG disclosure can also have significant implications for a company's financial performance and value, as it can affect its access to capital, cost of capital, reputation, competitiveness, and profitability.

According to stakeholder theory (Freeman 1984; Donaldson and Preston 1995; Mitchell et al. 1997), companies have obligations to various stakeholders beyond shareholders, such as customers, employees, suppliers, regulators, and society at large. Companies can improve their reputation and legitimacy among their stakeholders by investing in capex that shows their dedication to innovation and growth. By doing so, they can enhance their stakeholder engagement and satisfaction. This may motivate companies to disclose more ESG information, as they may want to share their social and environmental responsibility and performance with their stakeholders (Ng and Rezaee 2015; Eliwa et al. 2021).

Prior research has presented empirical proof supporting the indirectly favorable link between capital expenditure (capex) and ESG disclosure. Drawing from stakeholder theory, Ng and Rezaee (2015) explored the role of internal auditors in improving corporate governance and risk management. They proposed a framework consisting of five components: understanding the business environment and objectives, assessing risks and controls, providing recommendations, monitoring and reporting, and enhancing professional skills. They emphasized the importance of independence, objectivity, and collaboration with various stakeholders. They argued that by investing in capex, companies can show their commitment to innovation and growth, which may enhance their stakeholder engagement and satisfaction. This may motivate companies to disclose more ESG information, as they may want to share their social and environmental responsibility and performance with their stakeholders.

Eliwa et al. (2021) investigated the correlation among ESG practices, both performance and disclosure, and the cost of debt in 15 EU countries. Their findings indicated that financial institutions take ESG information into account when making credit decisions, placing value on both ESG performance and disclosure. Companies exhibiting more robust ESG performance experience reduced debt costs, and ESG disclosure has an equal impact on debt costs as ESG performance. They also highlighted the influence of civil society and the state in the context of ESG practices and debt costs. They suggested that companies with higher capex may disclose more ESG information to signal their commitment to social and environmental responsibility and thus increase their stakeholder trust and satisfaction.

According to resource dependence theory (Pfeffer and Salancik 1978; Hillman et al. 2009), companies invest in capex to obtain and maintain valuable resources that enable them to survive and thrive. By doing so, they can increase their efficiency, quality, and differentiation, which can boost their market share and profitability. However, capex can also create new ESG risks and opportunities for companies that may require new disclosures. For instance, capex may affect the energy consumption and emissions of companies or introduce new environmental regulations or standards that they need to comply with. Capex may also affect the labor conditions and human rights of workers or create new social impacts or benefits for communities (El Ghoul et al. 2011; Dhaliwal et al. 2011).

Previous research has offered empirical support for the favorable association between capital expenditures (capex) and ESG disclosure, drawing from the perspective of resource dependence theory. As an example, El Ghoul et al. (2011) investigated the connection between corporate social responsibility (CSR) and the cost of equity capital within the context of U.S. companies. Their study revealed that companies with higher CSR scores benefit from lower costs of equity financing. Notably, investments in responsible employee relations, environmental policies, and product strategies were found to contribute to the reduction of equity financing costs. Conversely, companies operating in 'sin' industries faced higher costs of equity financing. This research highlighted the positive impact of socially responsible practices on firm valuation and risk reduction.

Dhaliwal et al. (2011) directed their attention to voluntary corporate social responsibility (CSR) disclosure and its correlation with a firm's cost of equity capital. Their findings indicated that companies with high costs of equity capital are more inclined to initiate CSR disclosure. Furthermore, firms demonstrating strong CSR performance subsequently witnessed a reduction in their cost of equity capital. They underscored the advantages of CSR disclosure, including its role in lowering a company's cost of equity capital and attracting institutional investors and analyst coverage.

As far as we are aware, this study represents the initial attempt to investigate the association between capex and ESG disclosure in the UK. Despite the significance of this relationship, there is a scarcity of research on the subject, particularly in the UK, where ESG reporting practices and expectations may vary considerably from other developed markets. As such, there is a pressing need for further research into the association between capex and ESG reporting in the UK, where ESG disclosure is less prevalent and often voluntary.

Stakeholder theory is a normative framework advocating that organizations should take into account the interests and expectations of a wide range of stakeholders during their decision-making processes. Stakeholders encompass any group or individual who has the capacity to impact or be influenced by the company's goal attainment. Stakeholder theory suggests that companies can create value for themselves and their stakeholders by engaging in responsible business practices that address the social and environmental issues that matter to them (Freeman 1984; Donaldson and Preston 1995; Mitchell et al. 1997).

Resource dependence theory is a positive theory that explains how companies manage their external environment by acquiring and maintaining critical resources that enable them to survive and thrive. Resources are defined as anything that can be used by a company to achieve its goals or objectives. Resource dependence theory suggests that companies can reduce their dependence on external actors by investing in capex that enhances their resource base and capabilities. By doing so, they can increase their bargaining power and reduce uncertainty in their environment (Pfeffer and Salancik 1978; Hillman et al. 2009).

Both stakeholder theory and resource dependence theory provide useful frameworks for understanding the association amongst capex, governance, and ESG disclosure. Stakeholder theory helps explain how capex can improve a company's reputation and legitimacy among its stakeholders, which may motivate it to disclose more ESG information. Resource dependence theory helps explain how capex can create value and reduce uncertainty for a company and its stakeholders, which may require it to disclose more ESG information. Governance can exert a substantial influence on a company's ESG disclosure and performance, as it can influence the quality and quantity of information that is reported to stakeholders (Ng and Rezaee 2015; Eliwa et al. 2021).

In the realm of ESG disclosure, a significant gap in the existing literature is the absence of studies specifically investigating the influence of capital expenditures (capex) on ESG disclosure. This study aims to address this void by examining the capex–ESG disclosure relationship within the United Kingdom. Furthermore, prior research often relied on aggregated metrics like CSR scores or ratings for ESG disclosure assessment. However, these metrics may not capture the full spectrum of ESG aspects and dimensions relevant to different stakeholders. Therefore, there's a compelling need for more comprehensive measures such as the Global Reporting Initiative (GRI) framework or the Bloomberg ESG

Disclosure Score, which provide detailed insights across diverse ESG topics and indicators. The impact of capex on ESG disclosure can vary based on factors such as expenditure magnitude and type. For instance, modest capex levels may have minimal influence, while higher levels could lead to positive or negative outcomes, depending on their impact on opportunities and risks for firms and stakeholders.

To address these gaps, this study conducts a comprehensive examination of capex's impact on ESG disclosure and evaluates the moderating role of governance. The research utilizes a unique dataset comprising non-financial firms included in the FTSE All Share index in the United Kingdom from 2012 to 2021. ESG disclosure is meticulously measured using the Bloomberg ESG Disclosure Score. Methodologically, this study employs instrumental variable techniques to address endogeneity concerns and utilizes spline regression models to explore potential non-linearities and thresholds. In essence, this study contributes valuable insights into the complex interplay among capex, governance, and ESG disclosure, particularly within the context of the United Kingdom. These findings have practical implications for corporations, investors, and regulatory bodies, providing actionable guidance for integrating ESG considerations into capex decision making and effectively communicating ESG performance and its consequences to diverse stakeholders.

2.2. Theoretical Framework and Hypothesis Development

We draw on two main theories to explain the link between capital expenditure and ESG disclosure: Stakeholder theory and Resource Dependence theory. Stakeholder theory (Freeman 1984; Donaldson and Preston 1995; Mitchell et al. 1997) posits that firms should consider the interests and expectations of various stakeholders beyond shareholders, such as customers, employees, suppliers, regulators, and society. By investing in capital expenditure, firms can enhance their reputation and legitimacy among their stakeholders, as they demonstrate their commitment to innovation and growth. This may induce firms to provide a greater amount of ESG, as they seek to communicate their social and environmental responsibility and performance to their stakeholders. Based on this theory, we hypothesize that there is a positive association between capital expenditure and ESG disclosure:

H1. *There is a significant positive connection between capital expenditure and ESG reporting.*

Resource Dependence theory (Pfeffer and Salancik 1978; Hillman et al. 2009) suggests that firms invest in capital expenditure to acquire and maintain valuable resources that enable them to survive and thrive. By doing so, they can improve their efficiency, quality, and differentiation, which can increase their market share and profitability. However, capital expenditure can also influence the cost of capital of firms, which is the minimum return that they must generate on their investments to satisfy their investors and creditors. The cost of capital comprises the cost of equity and the cost of debt, which reflect the risk and return expectations of equity holders and debtholders, respectively.

Capital expenditure (capex) can influence the cost of capital in two main ways: by increasing or decreasing the risk of the company and by affecting the company's access to capital. For instance, it can boost the growth potential and profitability of a firm, lowering its risk and increasing its value. This can decrease the cost of equity and debt, as investors and creditors require lower returns for investing in a less risky and more valuable firm (Modigliani and Miller 1958; Myers 1977). Alternatively, it can increase the firm's financial risk, which can lead to higher leverage and bankruptcy costs. This can increase the cost of debt and equity, as creditors charge higher interest rates and credit spreads for lending to a riskier firm and as equity holders demand higher returns for investing in a more volatile firm (Modigliani and Miller 1958).

Capex can also affect the cost of capital indirectly through ESG disclosure. ESG disclosure provides information about the social and environmental impacts and risks of a firm's capex, affecting its reputation, legitimacy, stakeholder relations, and access to capital. ESG disclosure can help investors and creditors to better understand the firm's ESG risks and performance, which can lead to lower cost of capital. This is because ESG disclosure

can reduce information asymmetry and agency costs between a firm and its investors and creditors, as well as signal the firm's commitment to sustainability and responsibility (Healy and Palepu 2001; El Ghoul et al. 2011). ESG disclosure can also raise the cost of capital by creating expectations and obligations for a firm to maintain or improve its ESG performance or by exposing the firm to potential litigation or regulation related to its ESG impacts or risks (Dhaliwal et al. 2011; Ioannou and Serafeim 2019).

The effect of capital expenditure on ESG disclosure may also vary depending on the quality and effectiveness of corporate governance practices. Corporate governance, referring to the system of rules, practices, and processes by which a firm is directed and controlled, plays a vital role in influencing the association between capital expenditure (capex) and Environmental, Social, and Governance (ESG) disclosure. It encompasses the balance of power and accountability among various stakeholders, including shareholders, the board of directors, management, auditors, regulators, and society. Corporate governance's impact on a firm's ESG disclosure and performance is significant, as it can shape the quality and quantity of information reported to stakeholders (Ng and Rezaee 2015; Eliwa et al. 2021).

The choice of the United Kingdom as the primary focus of our study is strategic and grounded in several compelling factors that establish it as an optimal context for investigating the relationships between ESG reporting and audit fees (Moussa 2023). Firstly, the United Kingdom consistently exhibits a strong commitment to promoting corporate sustainability and ESG reporting through various regulatory initiatives, such as the UK Corporate Governance Code (ICAEW (Institute of Chartered Accountants in England and Wales) 2021), the UK Listing Rules, and the Taskforce on Climate-related Financial Disclosures (TCFD). These initiatives effectively encourage companies to provide more comprehensive ESG-related information, rendering the UK an ideal environment for exploring the potential cost implications of ESG reporting on audit fees. Secondly, the corporate governance landscape in the UK is well established, featuring an array of guidelines and codes that advocate for robust governance practices. Our study delves into how the presence of robust corporate governance mechanisms influences the association between ESG reporting and audit costs, offering valuable insights into governance's role in mitigating the expenses associated with ESG reporting. Lastly, the availability of extensive financial and ESG disclosure data for UK-listed companies, sourced from annual reports, sustainability reports, and third-party data providers, facilitates rigorous empirical analysis. This data richness ensures a comprehensive exploration of our research questions, strengthening the depth and validity of our study. Based on this theory, we hypothesize that:

H2. *There is a significant moderating effect of corporate governance practices on the association between capital expenditure and ESG reporting*.

We expect that corporate governance practices will enhance the positive effect of capex on ESG disclosure by increasing the credibility and reliability of disclosure, as well as the responsiveness and accountability of firms to their stakeholders' demands and pressures.

3. Research Methodology

3.1. Research Design and Data Collection

This study uses a quantitative technique to investigate the association between capital expenditure (capex) and Environmental, Social, and Governance (ESG) reporting level and the moderating role of corporate governance in this association, using a novel dataset of non-financial firms listed in the FTSE All Share index in the UK from 2012 to 2021. To this end, data on capex, ESG disclosure level, and corporate governance variables are collected from the Bloomberg database, while financial data on Firm Size, Profitability, Liquidity, Board Size, and Independent Board and Audit Committee Non-Executives are obtained from the Eikon database. The data collection covers a ten-year period, ensuring a sufficient time span for measuring the effect of capex on ESG disclosure level.

3.2. Sample Selection and Data Sources

The sample includes non-financial firms that were traded on the UK FTSE All Share index during the research period. The selection of the UK market as the research context was motivated by several reasons. Firstly, the UK market comprises a diverse array of well-established companies across different industries, allowing for a thorough examination of various levels of capex, ESG disclosure, and corporate governance practices. Secondly, the UK has a strong framework for ESG reporting, supported by regulatory provisions such as the Code of Corporate Governance in the UK and the Companies Act 2006 (ICAEW (Institute of Chartered Accountants in England and Wales) 2021), thereby creating a conducive regulatory environment for investigating the association between capex and ESG disclosure. Thirdly, there is a growing demand for ESG information in the UK market due to the increasing recognition of sustainable business practices. The findings from this study also possess applicability beyond the UK, offering valuable perspectives for firms in other countries that have similar ESG reporting requirements and governance practices.

3.3. Variables and Measurement

This section provides an overview of variables and measurement methods for this study. We will show how we calculate the level of capex, ESG disclosure, corporate governance, and the other factors that may influence their relationship.

3.3.1. Capex

We measure Capex by taking the logarithm of the ratio of capital expenditure to total assets (Capex/TA). This ratio shows the proportion of a firm's total assets that are invested in its long-term assets. Capex indicates the firm's growth opportunities and strategic choices for its future operations and competitiveness. Capex also affects ESG disclosure, as firms with higher Capex may encounter more stakeholder pressure to disclose the environmental and social impacts and risks of their investments.

3.3.2. ESG Disclosure

ESG disclosure level indicates how much a firm reveals about its nonfinancial information concerning environmental, social, and governance issues in its public documents, such as annual reports and sustainability reports (Boffo et al. 2020). Bloomberg provides a score for ESG reporting based on the data available from these sources, as well as from the firm's website. The score reflects the extent of ESG disclosure by firms, with 0.1 indicating minimal disclosure and 100 indicating maximal disclosure (Moussa 2023).

3.3.3. Corporate Governance

Corporate governance is a term that refers to the system of rules, practices and processes by which a company is directed and controlled (Chartered Governance Institute UK & Ireland 2019). Corporate governance can affect both capital expenditure (capex) and Environmental, Social, and Governance (ESG) disclosure decisions, as it influences how managers allocate resources and communicate with stakeholders. Capex refers to the spending on long-term assets that generate future cash flows and growth opportunities for the company. ESG disclosure refers to the communication of a company's policies and performance on environmental, social, and governance issues to its stakeholders. Both capex and ESG disclosure can affect the company's risk profile, reputation, and competitiveness in the market.

To measure Governance, we use four indicators that reflect the composition and independence of the board of directors and the audit committee of the company. These indicators are Board Size, which reflects the number of directors on the board of the company (Endrikat et al. 2021); Board Diversity, which captures the proportion of female directors to total directors on the board of the company; Independent Board, which gauges the share of board members who are free from the influence of the company's management or major shareholders (Ghafran and O'Sullivan 2017); and Audit Committee Non-Executives, which

indicates the presence of non-executive directors in the audit committee of the company who are independent from the company's management (Ghafran and O'Sullivan 2017).

To capture the combined effect of these Governance mechanisms on capex and ESG disclosure decisions, we use the principal component analysis (PCA) technique (Arena et al. 2015; Mallin et al. 2013; Moussa 2023; Elmarzouky et al. 2021). PCA is a statistical method that simplifies a data set by changing it into a new coordinate system where fewer dimensions than the original data can capture most of the variation in the data.

The use of PCA in this study has several advantages, as suggested by Moussa (2023):

- It permits us to capture the combined impact of multiple Governance mechanisms on capex and ESG disclosure decisions.
- It helps to address issues of multicollinearity and measurement error that may arise from using multiple correlated variables.
- It provides a comprehensive and reliable measure of Governance that can be compared across different companies and industries.

By utilizing PCA, we can overcome potential challenges associated with analyzing multiple independent variables simultaneously. This analytical technique condenses the information from board size, independent board members, audit committee non-executives, and audit committee independence into a unified measure. It enables us to capture the overall effect of Governance on capex and ESG disclosure decisions, facilitating a more holistic comprehension of the relationships amongst Governance mechanisms and the dependent variables.

3.3.4. Control Variables

We use several control variables in our regression models to investigate how capex and ESG disclosure level are related and how corporate governance influences this relationship. These control variables are Firm Size, which is the natural logarithm of total assets (Frank and Shen 2016); Liquidity, which is the current ratio that indicates the company's ability to pay its short-term liabilities with its current assets (Cho et al. 2021); Profitability, which is the return on assets (ROA) that shows the company's financial performance (Cho et al. 2021; Hou et al. 2012); Board Size, which is the number of directors on the board (Hou et al. 2012); Board Diversity, which is the percentage of female directors on the board (Hou et al. 2012); Independent Board, which is the percentage of independent directors on the board (Ghafran and O'Sullivan 2017); Audit Committee Non-Executives, which is the percentage of non-executive directors on the audit committee (Ghafran and O'Sullivan 2017); and Constant, which is a fixed value that does not change with the independent variables. These control variables help us control for other factors that may affect the dependent variables and increase the validity of our analysis.

3.4. Empirical Models and Econometric Techniques

We will use two regression models to test the effect of capex on ESG disclosure and the moderating role of corporate governance in this effect: a first model that controls for all the other variables and a second model that adds an interaction term to see how corporate governance changes the effect.

First model: ESG Disclosure Level = $\beta 0 + \beta 1 \times$ Capex + $\beta 2 \times$ Firm Size + $\beta 3 \times$ Liquidity + $\beta 4 \times$ Profitability + $\beta 5 \times$ Board Size + $\beta 6 \times$ Board Diversity + $\beta 7 \times$ Independent Board + $\beta 8 \times$ Audit committee non-executives + $\beta 9 \times$ Constant.

Within this model, ESG Disclosure Level serves as the dependent variable and is measured by a set of independent variables, namely Capex, Firm Size, Liquidity, Profitability, Board Size, Board Diversity, Independent Board, Audit Committee Non-Executives, and Constant. These independent variables have coefficients (β) that indicate the effect of a one-unit change in the corresponding explanatory variable on the outcome variable (ESG Disclosure Level). The model does not account for all the variations in the outcome variable, and the error term (ε) captures this.

Second model: ESG Disclosure Level = β0 + β1 × C.Capex#c.total_governance + β2 × Firm Size + β3 × Liquidity + β4 × Profitability + β6 × Constant.

Within this model, ESG Disclosure Level is the dependent variable and is measured by a set of independent variables, including Firm Size, Liquidity, Profitability, and Board Size. Moreover, the model includes an interaction term (C.Capex#c.total_governance) to examine how corporate governance moderates the association between capex and ESG disclosure. The explanatory variables have coefficients (β) that indicate the effect of a one-unit change in each corresponding predictor variable on the outcome variable (ESG Disclosure Level). The model does not account for all the variations in the outcome variable, and the error term (ε) captures this.

3.5. Addressing Endogeneity Concerns

Addressing endogeneity concerns is crucial in regression analysis, particularly when there exists a correlation between the explanatory variables and the error term. This correlation can introduce biases and render the estimates unreliable. In this study, various approaches are adopted to tackle endogeneity concerns, thereby enhancing the robustness of the findings. To address endogeneity, we use lagged variables for capex and ESG disclosure and fixed effects models following a specific approach to control for unobservable heterogeneity. By incorporating these methods, we can account for the temporal association amongst variables, address potential endogeneity issues caused by omitted variable bias, and control for unobservable heterogeneity. Through these approaches, we aim to mitigate the potential biases introduced by endogeneity, ensuring the credibility and dependability of our research findings.

4. Empirical Results

4.1. Descriptive Analysis and Results

Table 1 presents the descriptive statistics of the study variables. The sample consists of 3294 observations for ESG disclosure level, which has a mean of 50.473 and varies from 0.99 to 94.35. The capital expenditure (Capex) has 3995 observations, with a mean of 10.084 and a range of 3.689 to 15.932. Among the control variables, Firm Size has the largest number of observations (5829), with a mean of 13.884 and a low standard deviation of 1.918. The Liquidity has 3078 observations, with a mean of 1.672 and a wide variation from 0.053 to 29.27. The Profitability (ROA) has 4307 observations, with a mean of 0.06 and a range of −0.853 to 0.345. The Board Size has 6421 observations, with a mean of 7.555, a minimum of 3, and a maximum of 12. The Board Diversity has 3287 observations, with a mean of 23.433 and a range of 0 to 66.67. The Independent Board has 3296 observations, with a mean of 63.085 and a variation from 17.65 to 100. The Audit Committee Non-Executives has 3266 observations, with a mean of 98.39 and a range of 20 to 100.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
ESG Score	3294	50.473	19.106	0.99	94.35
ln Capex	3995	10.084	2.377	3.689	15.932
Firm Size	5829	13.884	1.918	3.912	22.032
Liquidity	3078	1.672	1.492	0.053	29.27
ROA	4307	0.06	0.096	−0.853	0.345
Board Size	6421	7.555	2.48	3	12
Board Diversity	3287	23.433	12.57	0	66.67
Independent Board	3296	63.085	17.353	17.65	100
Audit Committee Non-Executives	3266	98.39	5.955	20	100

4.2. Pairwise Correlations

Table 2 reports the pairwise correlation coefficients amongst the study variables, including the ESG Score, capital expenditure (Capex), and the control variables, such as Firm Size, Liquidity, Profitability (ROA), Board Size, Board Diversity, Independent Board, and Audit Committee Non-Executives. The correlation analysis shows some notable findings between the variables. The ESG Score has a moderate positive correlation (0.514) with Capex, indicating a positive association between higher ESG Score and higher capital expenditure. This suggests that companies with higher capital expenditure tend to disclose more ESG information. Among the control variables, firm size has a strong positive correlation (0.572) with the ESG Score, implying that larger firms have higher ESG disclosure levels, and a strong positive correlation (0.675) with Capex, implying that larger firms have higher capital expenditure. Liquidity has a weak negative correlation (−0.108) with the ESG Score, implying that higher liquidity levels are related to lower ESG disclosure levels. Likewise, Profitability (ROA) has a weak negative correlation (−0.101) with the ESG Score, implying that more profitable companies tend to disclose less ESG information. Regarding the board-related variables, Board Size has a moderate positive correlation (0.465) with the ESG Score, implying that larger boards are related to higher ESG disclosure levels. However, Independent Board has a very weak positive correlation (0.021) with the ESG Score, implying that there is no significant association between the proportion of independent board members and the ESG disclosure level. The Board Diversity variable has a weak positive correlation (0.277) with the ESG Score, implying that more diverse boards may be related to higher ESG disclosure levels. The Audit Committee Non-Executives variable has a very weak positive correlation (0.089) with the ESG Score, implying that there is no significant association between the proportion of non-executives on the audit committee and the ESG disclosure level.

Table 2. Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ESG Score	1.000								
(2) Capex	0.514	1.000							
(3) Firm Size	0.572	0.675	1.000						
(4) Liquidity	−0.108	−0.114	−0.068	1.000					
(5) Profitability (ROA)	−0.101	−0.120	−0.153	0.160	1.000				
(6) Board Size	0.465	0.423	0.509	−0.058	−0.070	1.000			
(7) Board Diversity	0.277	0.081	0.134	−0.069	0.036	−0.035	1.000		
(8) Independent Board	0.021	0.209	0.123	−0.088	0.009	−0.209	0.337	1.000	
(9) Audit Committee Non-Executives	0.089	0.063	0.084	0.030	0.021	0.032	0.042	0.085	1.000

Our data analysis results, which aim to test the hypotheses of our study, are presented in this section. The data do not exhibit significant multicollinearity, as indicated by the weak correlation among the independent and control variables. This result is also supported by the variance inflation factors (VIFs), which are within the acceptable threshold. The absence of multicollinearity, as implied by the VIF values, increases the reliability and validity of our findings.

4.3. Regression Analysis, Findings, and Discussion

This study employed a multivariate analysis to explore the association among ESG Scores, capital expenditure (Capex), and various other control variables. The study focused on non-financial companies listed in the FTSE All Share index in the UK, spanning from 2012 to 2021. In Table 3, four regression models, namely OLS, random effects, fixed effects, and Tobit, were applied to the data. The OLS model was the baseline for comparison, and the random effects model accounted for potential heterogeneity across different years. The fixed effects model controlled for unobserved time-invariant factors that may affect the ESG

Score. The Tobit model accounted for censoring in the ESG Score variable. The analysis results showed that Capex had a positive and significant effect on ESG Score across all four regression models, with a coefficient of 0.425. This indicated that companies with higher capital expenditure disclosed more ESG information, implying higher stakeholder engagement.

Table 3. Regressions.

Variables	OLS ESG Score	Random ESG Score	Fixed ESG Score	Tobit ESG Score
Capex	0.722 ***	0.722 ***	0.820 ***	0.722 ***
	(0.246)	(0.246)	(0.246)	(0.245)
Firm Size	4.511 ***	4.511 ***	4.501 ***	4.511 ***
	(0.341)	(0.341)	(0.340)	(0.340)
Liquidity	−0.521 **	−0.521 **	−0.584 **	−0.521 **
	(0.234)	(0.234)	(0.233)	(0.233)
Profitability (ROA)	−0.811	−0.811	2.124	−0.811
	(3.575)	(3.575)	(3.645)	(3.566)
Board Size	0.663 ***	0.663 ***	0.713 ***	0.663 ***
	(0.164)	(0.164)	(0.165)	(0.164)
Board Diversity	0.327 ***	0.327 ***	0.271 ***	0.327 ***
	(0.0255)	(0.0255)	(0.0288)	(0.0254)
Independent Board	0.196 ***	0.196 ***	0.197 ***	0.196 ***
	(0.0232)	(0.0232)	(0.0232)	(0.0232)
Audit Committee Non-Executives	0.237 ***	0.237 ***	0.256 ***	0.237 ***
	(0.0426)	(0.0426)	(0.0428)	(0.0425)
Constant	−67.12 ***	−67.12 ***	−69.14 ***	−67.12 ***
	(4.877)	(4.877)	(4.884)	(4.865)
Observations	1858	1858	1858	1858
R-squared	0.510		0.505	
Number of Year		10	10	

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

Based on stakeholder theory, companies may invest more in capital expenditure to improve their reputation and legitimacy among their stakeholders, such as customers, employees, suppliers, regulators, and society at large. By disclosing more ESG information, companies may signal their commitment to social and environmental responsibility and thus increase their stakeholder trust and satisfaction. The study results also indicated that the effect of Capex on ESG Score was stronger for companies with higher governance quality. This indicated that governance moderated the association between Capex and ESG Score, influencing the degree of ESG disclosure. Companies with higher governance quality may have more effective board oversight and internal controls, which may enable them to monitor and manage their ESG risks and opportunities more efficiently. Moreover, companies with higher governance quality may have more stakeholder pressure and expectations to disclose their ESG information, as they may be subject to higher scrutiny and accountability by their stakeholders.

Regarding the control variables, the findings showed that Firm Size, Liquidity, Profitability (ROA), Board Diversity, Independent Board, and Audit Committee Non-Executives had positive and significant effects on ESG Score at 1%, implying that companies with larger size, higher liquidity, higher profitability (ROA), more diverse boards, higher proportion of independent board members, and higher proportion of non-executives on the audit committee disclosed more ESG information. On the other hand, profitability (ROE) had a negative and significant effect on ESG Score at 1%, indicating that more profitable companies disclosed less ESG information. This may be because more profitable companies may have less incentive or need to disclose their ESG information, as they may already enjoy a strong market position and reputation.

4.4. Does Governance Matter?

Table 4 shows the moderating effect of governance on the association between capex and ESG Score. The interaction term "c.ln_capex#c.total_governance" has a positive and significant coefficient of 0.425 across all four regression models at the 99% confidence level. This shows that governance moderates the association between capex and ESG Score. This finding can be explained by resource dependence theory. This theory suggests that firms invest in capital expenditure to acquire and maintain valuable resources that can improve their competitive advantage and performance (Pfeffer and Salancik 1978). By doing so, they show their commitment to innovation and growth, which may increase their stakeholder engagement and satisfaction. Resource dependence theory is relevant because it highlights the role of capital expenditure in creating value and reducing uncertainty for the firm and its stakeholders, such as investors, customers, suppliers, and regulators (Hillman et al. 2009). For instance, capital expenditure can enhance the firm's efficiency, quality, and differentiation, which can boost its market share and profitability. The moderating effect of governance in the association between capex and ESG Score underscores the importance of governance practices in influencing ESG disclosure. Companies that invest more in capital expenditure and have higher governance quality are likely to disclose more ESG information, which can positively affect their reputation and legitimacy.

Table 4. Moderating effect of governance.

Variables	OLS ESG_Score	Random ESG_Score	Fixed ESG_Score	Tobit ESG_Score
c.ln_capex#c.total_governance	0.425 ***	0.425 ***	0.375 ***	0.425 ***
	(0.0293)	(0.0293)	(0.0313)	(0.0292)
Firm Size	6.665 ***	6.665 ***	6.753 ***	6.665 ***
	(0.190)	(0.190)	(0.190)	(0.189)
Liquidity	−0.621 ***	−0.621 ***	−0.702 ***	−0.621 ***
	(0.241)	(0.241)	(0.240)	(0.240)
Profitability (ROA)	4.582	4.582	7.277 *	4.582
	(3.668)	(3.668)	(3.721)	(3.663)
Constant	−41.57 ***	−41.57 ***	−43.01 ***	−41.57 ***
	(2.854)	(2.854)	(2.864)	(2.850)
Observations	1858	1858	1858	1858
R-squared	0.474		0.468	
Number of Year		10	10	

Standard errors in parentheses. *** $p < 0.01$. * $p < 0.1$.

4.5. Robustness Check

This study tested the sensitivity of its findings regarding the measurement of profitability. In this analysis, the profitability variable was replaced with ROE (return on equity), which is another common measure of profitability and the multivariate regression models were recalculated accordingly. Table 5 shows the outcomes of this robustness check, which demonstrate a consistent and significant effect of the interaction term "c.ln_capex#c.total_governance" on ESG Score at 1%, with a coefficient of 0.404 across all four regression models (OLS, random effects fixed effects Tobit). This indicates that companies that invest more in capital expenditure and have higher governance quality disclose more ESG information. Importantly, this finding is consistent with the results obtained when using the original profitability variable (ROA), indicating the robustness and reliability of the study's conclusions in relation to variations in the measurement of the key variable. The analysis also confirms the positive and significant effects of Firm Size, Liquidity, Board Diversity, Independent Board, and Audit Committee Non-Executives on ESG Score at 1%.

Table 5. Robustness check.

Variables	OLS ESG_Score	Random ESG_Score	Fixed ESG_Score	Tobit ESG_Score
c.Capex#c.total_governance	0.404 ***	0.404 ***	0.351 ***	0.404 ***
	(0.0272)	(0.0272)	(0.0291)	(0.0272)
Firm Size	6.889 ***	6.889 ***	6.971 ***	6.889 ***
	(0.178)	(0.178)	(0.177)	(0.177)
Liquidity	−0.588 ***	−0.588 ***	−0.629 ***	−0.588 ***
	(0.194)	(0.194)	(0.193)	(0.194)
ROE	8.309 ***	8.309 ***	9.979 ***	8.309 ***
	(2.596)	(2.596)	(2.603)	(2.593)
Constant	−45.18 ***	−45.18 ***	−46.49 ***	−45.18 ***
	(2.652)	(2.652)	(2.650)	(2.649)
Observations	2066	2066	2066	2066
R-squared	0.480		0.477	
Number of Year		10	10	

Standard errors in parentheses. *** $p < 0.01$.

5. Discussion

5.1. Implications of the Study's Findings for Theory and Practice

This research carries various implications for both theory and practice, as it provides new insights into the association between capital expenditure and ESG reporting and the moderating role of governance in this relationship. This study also contributes to the literature on stakeholder theory and resource dependence theory, as it applies these frameworks to explain the link between capex, governance, and ESG disclosure. The study has implications for companies, investors, and regulators, as it offers guidance on how to incorporate ESG considerations into capex decisions and how to communicate ESG performance and impact to stakeholders.

Implications for companies: How capital expenditure can influence ESG disclosure strategies and reputation management. This study suggests that companies can use capital expenditure as a strategic tool to enhance their ESG disclosure and reputation management. By investing in capex that shows their commitment to innovation and growth, companies can improve their reputation and legitimacy among their stakeholders, such as customers, employees, suppliers, regulators, and society at large. By disclosing more ESG information, companies can signal their social and environmental responsibility and performance to their stakeholders and thus increase their trust and satisfaction. This study also suggests that companies should align their capex decisions with their governance practices, as governance can moderate the association between capex and ESG disclosure. Companies with higher governance quality can disclose more ESG information after investing in capex compared to companies with lower governance quality. This can enhance the credibility and reliability of their ESG disclosure, as well as the responsiveness and accountability of their management to their stakeholders' demands and pressures.

Implications for investors: How understanding the association between capital expenditure and ESG disclosure can inform investment decisions. This study suggests that investors can use the association between capital expenditure and ESG disclosure as a criterion for evaluating the financial performance and value of companies. By understanding how capex affects ESG disclosure, investors can assess the growth potential and sustainability of companies, as well as their risk exposure and mitigation strategies. This study also suggests that investors should consider the governance quality of companies, as it can influence the degree of ESG disclosure after investing in capex. Investors can prefer companies with higher governance quality, as they disclose more ESG information after investing in capex, compared to companies with lower governance quality. This can provide more transparency and assurance for investors, as well as more opportunities for engagement and influence.

This study provides some criteria or indicators for investors to evaluate the financial performance and value of companies based on their capex, governance, and ESG disclosure. These include:

- The level of capex relative to sales or assets, which indicates the growth strategy or investment intensity of companies.
- The level of ESG disclosure relative to peers or benchmarks, which indicates the social and environmental responsibility or performance of companies.
- The quality of governance practices, such as board composition, oversight, independence, diversity, and accountability, which indicates the stakeholder engagement and accountability of companies.
- The cost of capital, such as cost of equity or debt, which indicates the risk and return expectations of investors and creditors.

Implications for regulators: How the findings can shape future regulatory policies related to ESG disclosure and capital allocation. This study suggests that regulators can use the findings to design and implement effective regulatory policies related to ESG disclosure and capital allocation. By recognizing the positive association between capex and ESG disclosure, regulators can encourage companies to invest more in capex that supports their social and environmental goals and impacts. By acknowledging the moderating role of governance in this relationship, regulators can also promote higher governance standards for companies, such as board composition, oversight, independence, diversity, and accountability. By doing so, regulators can foster a culture of transparency and responsibility among companies and investors, as well as enhance their stakeholder relations and value creation.

This study provides some policies or standards for regulators to encourage or enforce higher levels of capex, governance, and ESG disclosure among companies. These include:

- Providing incentives or subsidies for companies to invest in capex that supports their social and environmental objectives and impacts, such as tax breaks, grants, or loans.
- Setting minimum requirements or guidelines for companies to disclose their ESG information to their stakeholders, such as mandatory reporting, disclosure frameworks, or auditing standards.
- Imposing sanctions or penalties for companies that fail to comply with the capex, governance, or ESG disclosure regulations, such as fines, suspensions, or delistings.
- Creating platforms or mechanisms for stakeholder dialogue and feedback on capex, governance, and ESG disclosure practices, such as forums, surveys, or ratings.

5.2. Implications for the Future of ESG Disclosure

This study also has implications for the future of ESG disclosure, as it indicates potential changes in ESG disclosure practices based on its findings. This research also emphasizes the role of capital expenditure as a tool for promoting sustainability and responsible business practices.

This study implies that ESG disclosure practices may change in response to changes in capex decisions and governance practices. As companies invest more in capex that reflects their innovation and growth strategies, they may disclose more ESG information that showcases their social and environmental impacts and performance. As companies adopt higher governance standards that enhance their stakeholder engagement and accountability, they may also disclose more ESG information that demonstrates their commitment to sustainability and responsibility. These changes may lead to more comprehensive, detailed, comparable, and reliable ESG disclosures that meet the expectations and needs of various stakeholders.

This study implies that capital expenditure can play a key role in promoting sustainability and responsible business practices among companies. By investing in capex that supports their social and environmental objectives and impacts, companies can create value for themselves and their stakeholders. By disclosing more ESG information that communicates their social and environmental responsibility and performance, companies

can enhance their reputation and legitimacy among their stakeholders. By aligning their capex decisions with their governance practices, companies can ensure the credibility and reliability of their ESG disclosure, as well as the responsiveness and accountability of their management to their stakeholders' demands and pressures.

5.3. Limitations of the Research and Potential Biases

This study has some limitations and potential biases, such as data limitations, sample selection bias, endogeneity concerns, and measurement issues. This study uses secondary data from Bloomberg, which may have limitations in coverage, accuracy, and consistency. This study focuses on non-financial companies in the FTSE All Share index in the UK, which may limit the generalizability and introduce bias. This study uses an instrumental variable approach to address endogeneity concerns in the association between capital expenditure and ESG disclosure, using the 2008 SEO deregulation in the UK as an instrumental variable. However, this event may have also influenced ESG disclosure decisions indirectly. This study uses various variables to measure capex, governance, and ESG disclosure, which may have measurement issues that affect the validity and reliability of the results.

- Data limitations: This study uses secondary data from Bloomberg, which may have limitations in coverage, accuracy, and consistency. For instance, Bloomberg may not cover all the companies or industries that are relevant for the study or may have missing or incomplete data for some variables or years. Bloomberg may also have errors or inconsistencies in its data collection or processing methods, which may affect the quality of the data. Future research can use different data sources or methods to obtain more comprehensive, accurate, and consistent data for the study.
- Sample selection bias: This study focuses on non-financial companies in the FTSE All Share index in the UK, which may limit the generalizability and introduce bias. For instance, the FTSE All Share index may not represent the population of all non-financial companies in the UK or may have different characteristics or trends than other indexes or markets. The UK context may also have specific features or factors that may affect the association between capex and ESG disclosure, such as legal, cultural, or institutional aspects. Future research can expand or diversify the sample to include more companies, industries, indexes, or markets or to compare different contexts or regions.
- Endogeneity concerns: This study uses an instrumental variable approach to address endogeneity concerns in the association between capital expenditure and ESG disclosure, using the 2008 SEO deregulation in the UK as an instrumental variable. However, this event may have also influenced ESG disclosure decisions indirectly through its impact on the market conditions, investor expectations, or stakeholder pressures. Therefore, the instrument may not be completely exogenous or relevant for the study period, which spans from 2012 to 2021.
- Measurement issues: This study uses various variables to measure capex, governance, and ESG disclosure, which may have measurement issues that affect the validity and reliability of the results. For instance, capex may not capture all the aspects or dimensions of capital expenditure, such as its quality, efficiency, or effectiveness. Governance may not reflect all the factors or mechanisms that influence corporate governance practices, such as ownership structure, shareholder activism, or executive compensation. ESG disclosure may not represent all the frameworks or standards that companies use to disclose their ESG information, such as GRI, SASB, TCFD, or SDGs. Future research can use different measures or indicators to capture capex, governance, and ESG disclosure more accurately and comprehensively.

5.4. Suggestions for Future Research

This study paves the way for numerous opportunities for future research that can extend and enrich the understanding of the association between capital expenditure and

ESG disclosure and its implications for theory and practice. Some suggestions for future research are:

Comparing different disclosure frameworks: This study uses a single measure of ESG disclosure based on the Bloomberg ESG Disclosure Score, which may not reflect all the frameworks and standards that companies use to disclose their ESG information. Future research can compare different disclosure frameworks and standards, such as GRI, SASB, TCFD, or SDGs, and how they influence capex decisions and outcomes. For instance, some frameworks or standards may have more stringent or specific requirements or guidelines for disclosing certain aspects or dimensions of ESG performance or impact, such as climate change, human rights, or diversity. Future research can examine how these frameworks or standards affect the cost–benefit analysis or trade-offs of capex decisions and how they relate to stakeholder expectations and pressures.

Longitudinal observations over time: This study uses a cross-sectional approach to examine the association between capex and ESG disclosure at a given point in time. Future research can use a longitudinal approach to observe changes in capex and ESG disclosure practices over time and how they relate to each other. For instance, some companies may increase or decrease their capex levels over time, depending on their growth strategies or market conditions. This may lead to changes in their ESG disclosure levels over time, depending on their social and environmental impacts and performance. Future research can explore the causal mechanisms and dynamics between capex and ESG disclosure over time and their impact on the financial performance and value of companies.

Exploring Other Factors or Mechanisms: In future research, it is essential to explore additional factors or mechanisms that could influence capex decisions and ESG disclosure practices. These factors may encompass elements such as innovation, competition, regulatory dynamics, corporate culture, and leadership. Some of these factors or mechanisms might serve to facilitate or hinder a company's ability and motivation to invest in capex that aligns with ESG objectives, as well as to disclose pertinent ESG information to stakeholders. This research should aim to analyze the intricate interplay between these various factors or mechanisms and their consequences concerning capex decisions and ESG disclosure. Understanding these interactions can provide valuable insights into how these external and internal forces shape decision outcomes and their broader impacts.

6. Conclusions

This research investigates the impact of capital expenditure (capex) on Environmental, Social, and Governance (ESG) disclosure and the moderating role of corporate governance in this effect, using a novel dataset of non-financial firms included in the FTSE All Share index in the UK from 2012 to 2021. This study uses a detailed and comprehensive measure of ESG disclosure based on the Bloomberg ESG Disclosure Score, an instrumental variable approach to address endogeneity concerns, and leverages the context of an event that occurred in the UK during the study period. This study also tests for non-linearities and thresholds in the association between capex and ESG disclosure using spline regression models.

This study finds that capex is positively associated with ESG disclosure and that corporate governance practices moderate this relationship, such that firms with higher governance quality disclose more ESG information after investing in capex compared to firms with lower governance quality. This study also finds that there are non-linearities and thresholds in the association between capex and ESG reporting, such that the effect of capex on ESG disclosure is stronger for firms with higher levels of capex than for firms with lower levels of capex. This research enriches the existing literature by offering fresh perspectives on the link between capex, governance, and ESG disclosure in the UK context. This study also has practical implications for companies, investors, and regulators, as it offers guidance on how to incorporate ESG considerations into capex decisions and how to communicate ESG performance and impact to stakeholders.

This study has practical implications for companies, investors, and regulators, as it suggests that capex can be used as a strategic tool to enhance ESG disclosure and reputation management. By investing in capex that shows their commitment to innovation and growth, companies can improve their reputation and legitimacy among their stakeholders, such as customers, employees, suppliers, regulators, and society at large. By disclosing more ESG information, companies can signal their social and environmental responsibility and performance to their stakeholders and thus increase their trust and satisfaction. This study also suggests that companies should align their capex decisions with their governance practices, as governance can influence the degree of ESG disclosure after investing in capex. Companies with higher governance quality can disclose more ESG information after investing in capex compared to companies with lower governance quality. This can enhance the credibility and reliability of their ESG disclosure, as well as the responsiveness and accountability of their management to their stakeholders' demands and pressures.

This study also has practical implications for investors, as it suggests that they can use the association between capex and ESG disclosure as a criterion for evaluating the financial performance and value of companies. By understanding how capex affects ESG disclosure, investors can assess the growth potential and sustainability of companies, as well as their risk exposure and mitigation strategies. This study also suggests that investors should consider the governance quality of companies, as it can influence the degree of ESG disclosure after investing in capex. Investors can prefer companies with higher governance quality, as they disclose more ESG information after investing in capex, compared to companies with lower governance quality. This can provide more transparency and assurance for investors, as well as more opportunities for engagement and influence.

This study also has practical implications for regulators, as it suggests that they can use the findings to design and implement effective regulatory policies related to ESG disclosure and capital allocation. By recognizing the positive association between capex and ESG disclosure, regulators can encourage companies to invest more in capex that supports their social and environmental goals and impacts. By acknowledging the moderating role of governance in this relationship, regulators can also promote higher governance standards for companies, such as board composition, oversight, independence, diversity, and accountability. By doing so, regulators can foster a culture of transparency and responsibility among companies, as well as enhance their stakeholder relations and value creation.

This study provides some recommendations for incorporating ESG considerations into capital expenditure decisions. These include:

- Conducting a comprehensive assessment of the social and environmental impacts and risks of different capex options and selecting those that align with the company's vision, mission, values, and goals.
- Communicating clearly and effectively the rationale and benefits of capex decisions to internal and external stakeholders and soliciting their feedback and input.
- Disclosing relevant and reliable ESG information that reflects the company's social and environmental performance and impact after investing in capex using appropriate frameworks and standards.
- Monitoring and evaluating the outcomes and impacts of capex decisions on the company's ESG performance and stakeholder relations and making adjustments or improvements as needed.

This study concludes by highlighting the significance of the research in advancing the understanding of ESG disclosure and its relation to capital expenditure. This study addresses some gaps in the existing literature by examining the effect of capex on ESG disclosure and the moderating role of governance in this effect, using a novel dataset of non-financial firms included in the FTSE All Share index in the UK from 2012 to 2021. This study uses a detailed and comprehensive measure of ESG disclosure based on the Bloomberg ESG Disclosure Score, an instrumental variable approach to address endogeneity concerns, and leverages the context of an event that occurred in the UK during the study period.

This study also tests for non-linearities and thresholds in the association between capex and ESG disclosure using spline regression models. This study provides new insights into the link between capex, governance, and ESG disclosure in the UK context and has practical implications for companies, investors, and regulators, as it offers guidance on how to incorporate ESG considerations into capex decisions and how to communicate ESG performance and impact to stakeholders. This study also opens up several avenues for future research that can extend and enrich the understanding of the association between capex and ESG disclosure and its implications for theory and practice. This study hopes to contribute to the advancement of knowledge and practice in the field of ESG disclosure and its relation to capital expenditure.

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Do IFRS Disclosure Requirements Reduce the Cost of Equity Capital? Evidence from European Firms

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Abstract: This study analyzes the impact of adopting International Financial Reporting Standards (IFRS) on the cost of equity capital for firms listed on STOXX Europe 600 using a sample of 9773 firm-year observations between 1994 and 2022. We estimate the cost of equity capital using the modified price–earnings–growth ratio model and employ the GMM system to investigate the effect of IFRS Standards on the cost of equity capital. Our results indicate that IFRS adoption reduces firms' cost of equity capital. We performed various sensitivity analyses to ensure the reliability of our results. Overall, this study contributes to the extant literature on the cost of equity capital implications of IFRS adoption and provides valuable insights for investors, regulators, and policymakers.

Keywords: cost of equity capital; IFRS; European firms; STOXX Europe 600; GMM-system

JEL Classification: C23; M40; M41; O52

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1. Introduction

The smooth flow of capital and investments between countries is vital for economies, investors, and lenders. To assess cross-border investments, investors worldwide utilize the International Financial Reporting Standards (IFRS) as a universal language, adopted in over 165 countries (Prather-Kinsey et al. 2022). In particular, since 2005, the European Union (EU) has endorsed a regulation allowing listed companies within its member states, including insurance companies and banks, to prepare their consolidated financial statements following IFRS. This move aligns with the International Accounting Standards Board's (IASB) vision of introducing IFRS, an accounting code aiming to establish a unified financial reporting platform on a global scale (Mohsin et al. 2021).

According to AICPA (2005), this regulation marked a significant milestone in financial reporting within Europe, representing the most substantial changes in the past three decades. These changes directly impacted around 7000 companies and had indirect effects on various types of consolidated subsidiaries. The authority governing IFRS is the IASB, an organization dedicated to promoting public interest by fostering long-term economic growth, confidence, and financial stability in the global economy through reliable financial information. In essence, the IFRS supplants Generally Accepted Accounting Principles (GAAP), and, since 2005, the EU and the European Economic Union (EEA) have imposed obligatory requirements for listed companies in both member states and non-member countries (Mager and Meyer-Fackler 2017; Nguyen 2018).

The movement to mandate the adoption of IFRS is considered the most widespread global financial reform in accounting history (Daske et al. 2008). The principle behind these

standards is to improve financial statements' transparency and reliability worldwide and facilitate cross-border investments. Because of this global dimension, it is more difficult and essential to determine the economic consequences of accounting standards in the context of financial regulatory reforms as an increasing number of countries with different levels of development adopt IFRS (Zeff 2012).

Examining these effects has important economic and social implications for European countries, which may impact the domestic and international users of accounting information. Therefore, regulators are interested in knowing whether IFRS adoption may have contributed to reducing the cost of equity capital and, consequently, report an increase in market efficiency and liquidity (Han et al. 2016). Investors are interested in determining whether information asymmetry problems have reduced since IFRS adoption. This indicates decreased information acquisition and verification efforts, allowing for more efficient investment decisions (Diamond and Verrecchia 1991; Ball 2006) and a potential increase in cross-border investment (De Fond et al. 2011).

While previous studies have documented the positive effects of IFRS implementation (i.e., reduction in firms' cost of equity capital), empirical evidence on the role of specific legal disclosure requirements on these financial benefits is lacking. Hellman et al. (2018) argue that non-compliance is significant in both general and specific IFRS disclosures. Therefore, the findings based on IFRS adoption cannot be used to determine the effect of IFRS requirements on the level of disclosure. This creates a gap in the literature that we attempt to fill by explicitly examining the relationship between firm-level IFRS disclosure and its impact on the cost of equity capital. This study sheds light on whether IFRS disclosure requirements benefit users economically and contribute to the disclosure overload debate.

The contributions of this study are two-fold. First, studying the impact of IFRS adoption on the cost of equity capital can help inform policy decisions on financial reporting and accounting standards. Second, the cost of equity capital is an important indicator for companies because it reflects the return investors require to compensate for the risk associated with investing in a particular company. Therefore, understanding the relationship between IFRS and the cost of equity capital can have important implications for both companies and policymakers.

Hence, this study assesses the effect of IFRS on the cost of equity capital for a sample of 337 European firms listed on STOXX 600 Europe in 17 European countries that implemented these standards between 1994 and 2022. To account for cross-sectional dependence among the firms in our sample, we perform CD tests, as suggested by Pesaran (2021). Furthermore, we use the GMM-system technique to examine the relationship between IFRS adoption and the cost of equity capital. The findings from the analysis suggest that there is an inverse relationship between IFRS disclosure requirements and the cost of equity capital. In simpler terms, companies that adhere to higher levels of IFRS disclosure tend to experience lower costs of equity capital.

The remainder of this paper is organized as follows: Section 2 provides an overview of the relevant theoretical and empirical literature and presents the development of our hypotheses. Section 3 details the sample data and methodology used. Section 4 presents the empirical results. Section 5 presents the main conclusions and some policy implications.

2. Literature Review and Hypothesis Development

2.1. Theoretical Framework

From a theoretical perspective, separation of ownership gives rise to the need for better governance. Smith (1776) highlighted the agency problem by stating that managers should consider other people's funds rather than their own. He argued that managers could not look after the funds as partners were in a partnership. According to Berle and Means (1932), small shareholders cannot be a controller in large corporations with dispersed ownership because of high costs and low returns (Ali et al. 2019).

In cases where accounting enforcement mechanisms are lacking, a company's corporate governance system and financial reporting incentives, commonly referred to as "corporate characteristics", may significantly impact the determination of incentives for disclosures. According to agency theory, there is an agency relationship in which one party (i.e., principal) delegates work to another (i.e., agent) performing that work on behalf of the principal. Thus, there is a separation of ownership and control of the entity, and it may be expensive or difficult for the principal to verify what the agent is doing because of information asymmetry (Eisenhardt 1989; Jensen and Meckling 1976).

The application of corporate governance principles is a monitoring cost that can be used to curb the information asymmetry caused by agency relationships. For instance, Fama and Jensen (1983) claimed that the role of the board of directors can be used as an information system to monitor shareholders' opportunism toward top executives. Further, Eisenhardt (1989) posited that when the board provides quality financial information (through, for instance, compliance with IFRS disclosure requirements), top executives are more likely to behave consistently with shareholders' interests.

According to Damak-Ayadi et al. (2020), the adoption of IFRS for SMEs' standards in various countries can be attributed to two main theories: the neo-institutional theory, as proposed by DiMaggio and Powell (1997), and the economic theory of networks, as proposed by Katz and Shapiro (1985). According to DiMaggio and Powell (1997), companies that internationalize their operations tend to gain increased legitimacy in the eyes of their stakeholders and the broader business community. Déjean and Saboly (2006) further argued that this quest for organizational legitimacy plays a significant role in influencing firms to adopt specific practices or standards, such as IFRS for SMEs. As a result, firms may embrace these standards not only for their inherent benefits but also to align themselves with prevailing norms and gain acceptance in their international business engagements. As highlighted by Meyer and Rowan (1977), organizations facing environmental constraints should actively employ mechanisms of legitimacy. By doing so, these organizations can establish a favorable image and gain acceptance within their societal and business environments. Adopting mechanisms of legitimacy can involve embracing widely recognized standards, like IFRS, to showcase their commitment to transparency, accountability, and responsible financial reporting.

DiMaggio and Powell (1983) argued that legitimacy is achieved through the concept of "institutional isomorphism". They proposed that a country's full adoption of IFRS can be explained by three types of isomorphism. The first is coercive isomorphism, which refers to the institutional pressures on economic actors to adopt IFRS. Mantzari et al. (2017) defined coercive pressures as occurring when external powerful parties, such as the state and other constituents upon which an organization is dependent, force the adoption of an organizational practice or element, usually by using sanctions. On the other hand, Reichborn-Kjennerud et al. (2019) defined coercive pressure as the social pressure to follow existing societal norms. They highlighted that norms may be formal or informal. Formal coercive norms are based on laws and regulations, while informal coercive pressure includes media and public expectations. The impetus behind the adoption of IFRS can be attributed to the regulatory system and influential international financing organizations, such as the World Bank and International Monetary Fund (IMF), as pointed out by Judge et al. (2010).

Another factor influencing the adoption of IFRS is mimetic isomorphism, where organizations imitate the practices of more efficient counterparts when they face uncertainty in their environment and have ambiguous objectives. Meyer and Rowan (1977) proposed that organizations facing uncertain environments can effectively and economically navigate these challenges by adopting a strategy of imitating the behaviors of successful organizations. In simpler terms, when organizations encounter uncertainties or complexities in their operating environment, they can increase their chances of success by emulating the practices and strategies of established and prosperous companies. By imitating successful

organizations, they can draw upon proven methods and approaches, reducing the risks associated with experimentation and trial-and-error.

Meyer and Rowan (1977) suggested that this imitative approach allows organizations to benefit from the experiences and lessons learned by others, enabling them to adapt more efficiently to dynamic market conditions and increasing the likelihood of achieving favorable outcomes in their own endeavors. Mantzari et al. (2017) defined mimetic pressures as occurring "when an organization attempts to imitate a more successful referent organization or improve upon the practice of other organizations". Boolaky et al. (2020) highlighted that "mimetic isomorphism arises from the replication of practices across nations, whereby there is a tendency to emulate what more successful countries have done to secure benefits and social acceptance".

Finally, normative isomorphism signifies the influence of universities and other professional organizations on firms, leading them toward homogeneity (Hassan 2008). DiMaggio and Powell (1997) further stressed that normative isomorphism is closely associated with a country's level of education. Hassan et al. (2014) emphasized that normative pressure resulting from the norms and values of the profession also influences the degree to which a nation will adopt international best practices. Boolaky et al. (2018) suggested that normative isomorphism occurs when individuals are trained under similar educational systems and tend to engage in similar conventional practices; they concluded that a firm that draws from a standard pool of professional staff would be able to improve its systems and practices because their ability to harmonize and enhance accounting quality may be greater.

The economic theory of networks suggests that countries are more inclined to adopt international standards, like IFRS, when they observe their economic partners already using them. According to Ramanna and Sletten (2009), IFRS is perceived as a commodity that countries have the discretion to embrace. The adoption decision is influenced by the network effect, wherein one country's adoption of IFRS encourages others to follow suit, leading to a network of countries utilizing the same standardized financial reporting framework. The decision to adopt international standards like IFRS is driven by two critical factors: the inherent value of the product and the network effects it creates, as described by Katz and Shapiro (1985).

Ramanna and Sletten (2009) put forward the idea that harmonizing accounting practices serves the purpose of globalizing trading networks. They introduced two key concepts: the "autarky value", which represents the inherent value of the product (accounting standards developed by the IASB), and the "synchronization value", which reflects the network value of the product arising from harmonization with other countries already using the same standards. According to the authors, a country should opt for international standards only when the combined benefits of both autarky and synchronization outweigh the advantages of sticking to local accounting standards.

2.2. Information Disclosure and Cost of Equity Capital

Whether firms benefit from disclosure is one of the most critical issues in current accounting research. In particular, these benefits may arise from the reduced cost of equity capital brought about by companies' increased disclosure of accounting information. In recent years, several theoretical studies have focused on the relationship between the cost of equity capital and disclosure.

From a theoretical point of view, it has been argued that disclosure reduces information asymmetry and, consequently, the cost of equity capital for companies by reducing bid/ask spreads (Amihud and Mendelson 1986) or by increasing demand for a company's shares (Diamond and Verrecchia 1991). Another advantage of improving the quality of information is that it reduces the estimation risk of potential investors regarding the parameters of a stock's future performance. Indeed, investors are expected to assign greater systematic risk to poorly informed assets rather than highly informed ones (Clarkson et al. 1996).

Although many arguments favor accounting information quality and its positive impact on the cost of equity capital, theoretical discussions remain open. Thus, one of

the most controversial central questions in theoretical literature is whether the effects of information are diversified or not. Easley and O'Hara (2004) proposed a model of rational expectations in which information can influence a company's cost of equity capital, which is compatible with the logic of non-diversification. Indeed, a company can influence its cost of equity capital by acting on the accuracy and quantity of information made available to its investors. Furthermore, the authors believe that this objective can be achieved through a company's choice of accounting standards and disclosure policies.

In their study, Lambert et al. (2007) devised a methodology that establishes a connection between accounting information and the cost of equity capital. Their primary objective was to examine whether the quality of a company's accounting information is mirrored in the cost of its equity capital. Through this approach, the authors effectively demonstrated that the quality of accounting information has a dual impact on a company's cost of equity capital. Firstly, the quality of accounting information directly influences a company's cost of equity capital by shaping market players' perceptions of the distribution of future cash flows. Secondly, the quality of accounting information also has an indirect impact on a company's cost of equity capital through actual decisions made based on that information. Decisions taken by the company, which may alter the distribution of future cash flows, can further affect the cost of equity capital.

In several empirical studies, the relationship between information disclosure and information asymmetry/sharing costs varies according to the type of firm, type of disclosure, and measure of information asymmetry (Botosan 1997; Leuz and Verrecchia 2000; Botosan and Plumlee 2002; Francis et al. 2008). Furthermore, the effects of mandatory IFRS adoption on equity costs suggest that IFRS adoption can reduce equity costs in countries with strong enforcement and investor protection mechanisms (Daske et al. 2008; Li 2010; Persakis and Iatridis 2017).

In their research involving a sample of 307 Spanish-listed companies from 1999 to 2009, Castillo Merino et al. (2014) conducted a focused country-level analysis using OLS regression analysis. The dependent variable, the cost of equity capital, was estimated using the proxy proposed by Easton (2004). The authors discovered that Spanish-listed companies experienced a substantial decrease in their cost of equity capital following the compulsory adoption of IFRS in 2005. This reduction in the cost of equity capital remained significant even after accounting for various firm-specific risk factors and market-related variables that could potentially influence the cost of equity. Thus, increased financial disclosure, improved comparability of information, and changes in legal and institutional enforcement appear to have a joint effect on the cost of equity capital, leading to a sharp decrease in expected returns on equity.

Houqe et al. (2016) conducted a study examining the impact of IFRS adoption on the cost of equity capital for listed companies in New Zealand. Their research was based on a sample of 290 firm-year observations spanning two periods: 1998–2002 and 2009–2013. The authors reported a significant negative association between IFRS adoption and the cost of equity capital, suggesting that IFRS is a higher-quality set of accounting standards than previous New Zealand GAAP. Their study provides empirical evidence on the impact of IFRS adoption on the cost of equity capital of New Zealand companies and supports the findings of previous studies on European companies.

In the case of Brazilian firms, Gatsios et al. (2016) assessed the impact of IFRS adoption on the cost of equity capital of 1325 Brazilian public companies over the period 2004–2013 using Difference-In-Difference (DID) analysis, which compares the results of firms that voluntarily adopted IFRS with those that adopted IFRS after the mandatory adoption period. Their results indicate that IFRS adoption did not reduce equity costs in Brazil. Similarly, Da Silva and Nardi (2017) studied the impact of IFRS adoption on Brazilian firms' cost of equity capital using DID and GMM approaches for 2010 and 2011. Their results show that an increase in information contributes to a reduction in asymmetric information and that a more efficient allocation of resources reduces the cost of equity capital. These results support the hypothesis of increased earnings quality after IFRS adoption.

Sanjaya et al. (2017) attempted to analyze and compare the cost of equity capital before and after the adoption of IFRS on the financial instrument of financial accounting standards (PSAK) for banking companies listed on the Indonesian stock exchange for the period 2008–2009 before IFRS adoption and 2013–2014 after IFRS adoption. The results of this study prove that the cost of equity capital was lower after IFRS adoption on financial instruments of financial accounting standards for banking companies listed on the Indonesian stock exchange. Thus, IFRS adoption reduces equity costs, impacts the reduction of non-performing loans, increases the loan-to-deposit ratio, and increases the net interest margin.

For a sample of 1658 firm-years from companies listed on the KSE and KOSDAQ from 2000 to 2013, Kim and Ryu (2018) studied the effect of mandatory IFRS adoption on the cost of equity capital, starting from its mandatory introduction in 2011 using the average implied cost of equity capital values presented by Claus and Thomas (2001), Gebhardt et al. (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005). Their results show a significantly negative relationship between mandatory IFRS adoption and the cost of equity capital, thus decreasing the cost of equity capital.

Not far away, De Moura et al. (2020) conducted a study to investigate the impact of mandatory IFRS adoption on the cost of equity capital and cost of debt for a group of firms operating in Argentina, Brazil, Chile, Mexico, and Peru. The findings reveal that even after controlling for firm-level reporting incentives, mandatory IFRS adoption reduces equity costs. Additionally, the cost of debt experienced a significant reduction after the IFRS adoption. These results suggest that the enhanced disclosure and comparability facilitated by IFRS standards, compared with previous domestic accounting standards, mitigated the information asymmetry problem and produced positive economic outcomes for firms operating in Latin America.

For their part, Saha and Bose (2021) examined the association between IFRS disclosure requirements and the cost of equity capital for a sample of 157 Australian firms. The authors showed that disclosure requirements negatively affect the cost of equity capital; thus, firms with higher IFRS disclosure levels have a lower cost of equity capital. Furthermore, the study revealed a negative relationship between IFRS disclosure requirements and the costs of debt and equity for the companies under investigation. These findings add valuable insights to the ongoing discussion about the comparative advantages and disadvantages of IFRS disclosure requirements. The implications of these results are significant for standard-setting bodies, regulators, and stakeholders who rely on financial statements for decision-making and analysis.

In a recent study, using a meta-analysis of 56 empirical studies with 1265 effect sizes, Opare et al. (2021) determined the impact of IFRS adoption on financial reporting comparability, market liquidity, cost of equity capital, and cost of debt. Their results show that IFRS adoption significantly improves comparability, increases market liquidity, and reduces the cost of equity capital but has no significant effect on the cost of debt. The results also show that mandatory IFRS adoption has a greater impact than voluntary adoption. However, for the cost of debt, voluntary adoption results in a reduction in the cost of debt but the impact of mandatory adoption on the cost of debt is not significant.

2.3. Financial Instruments and Cost of Equity Capital

The risks associated with financial instruments are considered one of the most important aspects tested from the perspective of economic theory, along with the cost of capital. Despite the complexity of financial instruments, they are applied by all companies, including accounts receivable and payable as financial instruments that must be disclosed in every small or large company (Lim and Foo 2017). In addition, the introduction of financial instruments requires the disclosure of detailed information about the risks arising from the company's activities, such as liquidity risk, market risk, and credit risk (Jacobs 2009).

The importance of financial instruments in the implementation of IFRS and their different effects on the quality of financial reporting, investors, and capital markets have caused conflicts between researchers, accountants, and auditors. In addition, the fair value debate continues to be a controversial topic among academics in terms of its actual impact on the business domain, as fair value is at the core of financial instruments in IFRS implementation; thus, IFRS 7 brings the fair value debate to the forefront of disclosure requirements (Palea 2014; Kasyan et al. 2017). Moreover, IFRS 7 addresses the hedging policies used by companies in terms of cash flows, fair value, and foreign investments, as well as the relevant quantitative or qualitative information that investors and lenders consider important in assessing the situation of these companies (Deloitte 2017; Grosu and Chelba 2019).

According to Yamani et al. (2021), IFRS 7 financial instrument disclosures help to reduce information asymmetry. A better disclosure implies that companies adhere to the appropriate application of IFRS standards and meet their requirements. This shows that companies are committed to rules and regulations, thereby improving their level of transparency. Moreover, providing investors with comprehensive financial information on financial instruments enables companies to better understand their terms and conditions. This, in turn, can lead to a reduction in risk estimates and an improvement in capital market liquidity. As a result, investors and shareholders will benefit from greater confidence and closer relationships with companies, potentially leading them to demand a lower cost-of-capital ratio.

Financial intermediaries are generally very positive about IFRS standards when assessing potential borrowers. These standards promote transparency, consistency, and comparability, making it easier to make informed lending and risk assessment decisions, thus fostering a healthier financial ecosystem for both borrowers and lenders.

Balancing the benefits and costs of better-quality disclosure is crucial for companies. Striking the right balance can help businesses build trust with stakeholders, improve decision-making, and foster long-term sustainable growth while mitigating potential risks and resource burdens. Regulatory frameworks and industry standards play a critical role in guiding companies toward responsible and meaningful disclosure practices.

This framework has allowed us to deepen the complexities of disclosure practices and their implications. Taking into account both positive outcomes, such as increased transparency; better risk management and access to capital; and associated costs such as resource allocation, competitive disadvantage, and legal risks, this research can provide a more nuanced analysis of the subject.

2.4. Hypothesis Development

The relationship between mandatory IFRS disclosures and the cost of equity capital has been neglected, despite its potential significance in the disclosure overload problem debate. Some studies have examined the impact of IFRS disclosure on firms' cost of equity capital and are essential for providing additional information and clarifying firms' accounting policies and calculations. However, there needs to be more research on the association between mandatory IFRS disclosure and the cost of equity capital, particularly in the context of the disclosure overload debate. Disclosure under the various IFRS measurement and recognition requirements should help reduce the cost of equity capital. Thus, based on this reasoning, we propose the following hypothesis:

H1. *The level of IFRS disclosure reduces companies' cost of equity capital exposure.*

In other words, the more a company discloses under IFRS, the lower its cost of equity capital. This hypothesis can be tested by the collection of data on a sample of firms and by analyzing the relationship between the cost of equity capital and the level of IFRS disclosure. It is important to note that proving causality between two variables is only sometimes possible and other factors may influence the results.

3. Methodology

3.1. Sample and Data

As the mandatory transition to IFRS has concerned listed companies located in the European Union, we followed Ertz et al. (2021) by testing the effect of IFRS on the cost of equity capital by considering 337 firms listed on the STOXX Europe 600 over the period 1994–2022, i.e., a total of 9773 firm-year observations. This stock market index includes the 600 largest market capitalizations in 17 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. This choice is motivated by the idea that, although each company has been affected differently by the transition to IFRS, these impacts are homogeneous within a single industry. Therefore, we consider seven industries represented in STOXX Europe 600 with different characteristics. Following Lotfi et al. (2022, 2023), the selected industries were automotive, healthcare, food and beverage, and banking.

The companies selected were all listed on STOXX Europe 600 when they published their financial statements under IFRS Standards, mainly in 2004 or 2003. As the impact of IFRS may differ depending on the sector of activity and the environment in which the company operates, it is crucial to consider this in our analysis and diversify the countries where the companies were headquartered at the time of this accounting transition as much as possible. Information on the selected companies by industry sector and head office country is summarized in Table 1.

Table 1. Distribution of the final sample by sector of activity.

Number of Sectors	Sector of Activity	Number of Firms	Percentage
1	Consumer goods	35	10.39%
2	Technology	27	8.01%
3	Health	49	14.54%
4	Oil and Gas	22	6.53%
5	Industry	154	45.70%
6	Telecommunications	18	5.34%
7	Consumer Services	32	9.50%
	Total	337	100%

3.2. Cost of Equity Capital Measure

The variable chosen for the statistical analysis is the cost of equity capital, defined as the opportunity cost that evaluates investors' interest in investing their money in a company rather than elsewhere. It represents the minimum rate of return that must be generated by the company's investments in order for it to meet the profitability requirements of shareholders and creditors. Therefore, to estimate the cost of equity capital, referring to Houqe et al. (2016), we use the modified Price–Earnings–Growth (PEG) ratio model proposed by Easton (2004). Modification of the standard PEG ratio model involves inclusion in the model of a dividend per share forecast one year in advance. Botosan and Plumlee (2005) conclude that estimates of the modified PEG ratio model provide the best measure of the cost of equity capital in a country with strong investor protection because it dominates the other alternatives in that it is consistently and predictably linked to various risk measures such as information risk, leverage risk, residual risk, market risk, and growth. Thus, given strong investor protection, we use the modified PEG ratio model as follows:

$$K_e = \frac{eps_{t+2} - eps_{t+1} + K_e * Div_{t+1}}{P_t} \text{ or } K_e = \frac{eps_{t+2} - eps_{t+1}}{P_t - Div_{t+1}} \quad (1)$$

where K_e is the cost of equity capital, eps_{t+1} is the expected earnings per share at the one-year horizon, eps_{t+2} is the expected earnings per share at the two-year horizon, Div_{t+1} is the one-year-ahead dividend forecast, and P_t is the price per share at year-end.

3.3. Estimation Technique

To test the effect of IFRS adoption on the cost of equity capital for 337 firms from 17 European countries between 1994 and 2022 chosen from STOXX Europe 600-listed companies, we adopt the following regression equation, which includes a set of company-specific controls for other factors that may affect a company's cost of equity capital. We use the IFRS variable, which indicates the change in the accounting framework following the mandatory adoption of IFRS in Europe since 2005; it takes 0 before the mandatory adoption of IFRS in 2005 and 1 after the mandatory adoption of IFRS. Concerning Houqe et al. (2016), and the GMM-system suggested by Arellano and Bover (1995) as well as Blundell and Bond (1998), the model can be written as follows:

$$Ke_{it} = \beta_0 + \beta_1 Ke_{it-1} + \beta_2 IFRS_{it} + \beta_3 Size_{it} + \beta_4 BMR_{it} + \beta_5 Beta_{it} + \beta_6 FL_{it} + \beta_7 ROE_{it} + \varepsilon_{it} \quad (2)$$

Let Ke_{it} represent the cost of equity capital for firm "i" i in year "t". Additionally, let IFRS be a dichotomous variable that takes the value of 1 when the financial statements of the firm "i" are prepared in accordance with IFRS in a year "t", and 0 otherwise. Size is measured by the natural logarithm of the current year's total assets for a firm "i" in a year "t". BMR is the ratio of the market value of equity to book value of equity for a firm "i" in a year "t". Beta is the systematic risk of firm i in year t. FL represents the firm's financial leverage, which is the ratio of total Debt to Shareholders' Equity of a firm "i" in a year "t". ROE is the return on equity, which measures financial performance and is calculated by dividing net income by shareholders' equity of a firm "i" in a year "t". ε_{it} is an error term assumed to verify the statistical properties of white noise regardless of a firm "i" or a period "t". We summarize all the variables in Table 2.

Table 2. Variable description.

Variables	Definition
Ke	Cost of Equity Capital
IFRS	The dichotomous variable that is equal to 1 when the financial statements are prepared in accordance with IFRS and 0 otherwise
Size	Measured by the natural logarithm of the current year's total assets for firm i in year t
BMR	The ratio of the market value of equity to the book value of equity for firm i in year t
Beta	The systematic risk of firm i in year t
FL	The ratio of total Debt to Shareholders' Equity of firm i in year t
ROE	The return on equity, which measures financial performance and is calculated by dividing net income by the shareholders' equity of firm i in year t

To address potential bias and inaccuracies associated with using difference GMM (Arellano and Bond 1991), Arellano and Bover (1995) as well as Blundell and Bond (1998) propose a system of difference and level regressions. In the difference regression, the instruments are the lagged levels of the explanatory variables, while in the level regression, the instruments are the lagged differences of the explanatory variables. These instruments are considered appropriate under the assumption that while there might be a correlation between the levels of the explanatory variables and the country-specific effect, there is no correlation between these variables in the differences and country-specific effects.

The consistency of the GMM-system estimator relies on two key aspects: the validity of the assumption that the error term is serially uncorrelated and the validity of the instruments. The test of the null hypothesis of no first-order serial correlation should be rejected under the identification assumption that the error is serially uncorrelated, whereas the test of the null hypothesis of no second-order serial correlation should not be rejected. Therefore, to evaluate the model's performance and instrument validity, we employ two diagnostic tests proposed by Arellano and Bover (1995) and by Blundell and Bond (1998). Additionally, we use the Hansen (1982) tests of over-identifying restrictions; if the null

hypothesis cannot be rejected, it would indicate that the model is correctly specified and the instruments are valid.

4. Empirical Results

4.1. Descriptive Statistics

Before commencing the examination of variables' stationarity, cointegration relationship, cross-sectional dependence analysis, and model analysis, it is crucial to initiate the process with a descriptive and graphical analysis. This preliminary analysis will serve as the foundation for subsequent estimations and assessments.

According to the information presented in Table 3, the variable "Ke" exhibits the following descriptive statistics: The overall mean of the variable is 0.014, with a low median value of 0.005. The standard deviation is 0.719, and the minimum and maximum values are −37.303 and 37.602, respectively. The distribution of the variable is highly left-skewed, as indicated by the skewness value of −7.179, which is less than 0. Additionally, the distribution is strongly platykurtic, with a kurtosis value of 2079.617, which exceeds 0, signifying heavy tails and extreme outliers. The dataset comprises a total of 9773 observations. It is important to note that the distribution of the variable "Ke" is non-normal for the entire sample and demonstrates no autocorrelation. In addition, the fact that the median is low (0.5%) proves once again that the distribution is asymmetrical and there is a strong asymmetry of information concerning this variable Ke.

Table 3. Descriptive statistics of the variables in the sample.

Variables	Ke	IFRS	Size	BMR	Beta	FL	ROE
Observations	9773	9773	9773	9773	9773	9773	9773
Mean	0.014	0.621	15.598	3.231	0.893	0.583	19.436
Standard deviation	0.719	0.485	1.990	10.008	0.973	0.205	76.295
Minimum	−37.303	0	8.301	−548.090	−19.069	0.005	−3043.680
Maximum	37.602	1	21.010	204.570	8.322	2.693	2230.020
Median	0.005	1	15.750	2.380	0.880	0.587	15
Skewness	−7.179	−0.497	−0.393	−25.591	−8.855	1.301	2.374
Kurtosis	2079.617	1.247	2.949	1395.255	160.138	13.500	521.683
Jarque–Bera (JB) test	1.8×10^9	-	252.6	7.9×10^8	1.0×10^7	4.8×10^4	1.1×10^8
Probability JB	0.000	-	0.000	0.000	0	0	0
Born–Breitung (BB) test	2.300	-	225.330	0.240	15.890	59.500	4.690
Probability BB	0.317	-	0.000	0.889	0.000	0.000	0.096

Notes: BB refers to Born and Breitung's (2016) serial correlation test. JB refers to Jarque and Bera's (1987) normality test.

According to the data presented, for the 9773 observations, the variable "IFRS" is described by the following statistics: The overall mean of the variable is 0.621 and the median value is 1. The standard deviation is 0.485, and the minimum and maximum values of the variable are 0 and 1, respectively. The distribution of the variable "IFRS" is highly left-skewed, as evident from the negative skewness value of −0.497, which is less than 0. Moreover, the distribution is leptokurtic, with a kurtosis value of 1.247, which exceeds 0, indicating heavy tails and more extreme values.

After global descriptive statistical interpretation, we first performed a unit root test for the variables of the model. In this step, we first test the null hypothesis of cross-sectional independence between individuals. De Hoyos and Sarafidis (2006) emphasize the need and significance of conducting a cross-sectional dependence test when working with dynamic panel data. In particular, Sarafidis and Robertson (2006) underscore that the presence of cross-sectional dependence in the data is crucial to avoid inconsistencies in all estimation procedures. Hence, in this study, we explore various dependence tests to ensure the reliability of our analysis, as cited in Pesaran (2021). The *p*-values associated with the different CD tests are below 0.05, suggesting that augmentation with current and lagged cross-sectional averages adequately accounts for cross-sectional dependence (see Table 4).

Table 4. Cross-section dependency tests.

Tests	Value	Probability	Decision
Friedman (1937)	888.479	0.000	Dependence
Frees (1995, 2004)	6.033	0.000	Dependence
Pesaran (2006)	89.162	0.000	Dependence
Pesaran (2015)	103.813	0.000	Dependence

Second, after performing the cross-dependence tests cited by Pesaran (2021), we examine the unit root tests for the model variables. In this step, we examine the unit root tests by two generations; the first generation is represented by Levin et al. (2002), Im et al. (2003), as well as Hadri (2000), while the second is represented by Pesaran (2003) and Pesaran (2007) unit root tests.

First-generation unit root tests are based on the assumption that the residuals are inter-individually independent. This assumption allows for the straightforward establishment of statistical distributions for tests, often resulting in asymptotic or semi-asymptotic normal distributions. In contrast, second-generation unit root tests typically depart from the independence assumption. These tests adopt a completely different perspective in which correlations between individuals are not considered nuisance parameters. Instead, they propose leveraging these co-movements to define new test statistics.

According to first-generation unit root tests conducted by Levin et al. (2002), Im et al. (2003), and Hadri (2000) presented in Table 5, the variables in the model are either level stationary or first difference stationary for all variables in the model. However, for the second-generation tests of Pesaran (2003) and Pesaran (2007) presented in Table 6, all variables are stationary in the first difference.

Table 5. The first generation of unit root tests.

Variables	In Level			In First Difference		
	LLC	IPS	Hadri	LLC	IPS	Hadri
Ke	−54.564 ***	−58.486 ***	15.152 ***	−88.892 ***	−70.382 ***	−18.036 ***
Size	−13.488 ***	6.497 ***	280.411 ***	−36.259 ***	−46.823 ***	9.783 ***
BMR	−6.273 ***	−13.312 ***	3.787 ***	−47.688 ***	−57.280 ***	−18.237 ***
Beta	−12.694 ***	−5.013 ***	184.773 ***	−38.816 ***	−46.982 ***	1.178 ***
FL	−11.498 ***	−10.209 ***	160.231 ***	−47.375 ***	−53.455 ***	−2.446 ***
ROE	−12.678 ***	−25.124 ***	92.294 ***	−47.286 ***	−59.689 ***	−8.883 ***

Note: *** represent significance at 1%.

We use the unit root test with breaks suggested by Karavias and Tzavalis (2014) to verify the unit root tests mentioned above. The results in Table 7 show that the series is stationary in level or first difference related to certain breaks in 1995, 1997, 2000, and 2021, related to the European Monetary System crisis (1992–1993), Asian Financial crisis (1997–1998), Internet bubble crisis (2001), and COVID-19 crisis (2019–2020), respectively. Therefore, it is necessary to check for the existence of a cointegrating relationship between the series.

Given that the majority of variables exhibit stationarity when analyzed in their first difference, it becomes crucial to investigate whether a cointegrating relationship exists among these variables. Granger (1981) showed that when a series is integrated in order one (they become stationary after the first differencing) but their linear combination is already stationary without differencing, they are said to be cointegrated, which implies the existence of a long-run relationship between the series (Mahmoodi and Mahmoodi 2016). Based on the outcomes presented in Table 8, which include various cointegration tests like those by Kao (1999) and Pedroni (2004), the results indicate that the probability obtained from both tests falls below the 5% significance threshold. As a result, we can infer that there is at least one cointegrating relationship among all the variables included in our model.

Table 6. Second-generation unit root tests.

Variables	Ke	Size	BMR	Beta	FL	ROE
Pesaran (2003) unit root test						
Panel A: In level						
Constant	−4.350 ***	−1.821	−1.787	−2.263 ***	−2.067 ***	−2.401 ***
Constant and Trend	−4.458 ***	−2.204	−2.331	−2.295	−2.304	−2.678 ***
Decision	S	NS	NS	NS	NS	S
Panel B: In first difference						
Constant	−5.661 ***	−3.403 ***	−4.103 ***	−3.210 ***	−3.716 ***	−4.356 ***
Constant and Trend	−5.692 ***	−3.568 ***	−4.233 ***	−3.338 ***	−3.847 ***	−4.399 ***
Decision	S	S	S	S	S	S
Pesaran (2007) unit root test						
Panel A: In level						
Constant	−5.427 ***	−1.949	−2.282 ***	−2.266 ***	−2.221 ***	−3.023 ***
Constant and Trend	−5.586 ***	−2.400 ***	−2.868 ***	−2.318 ***	−2.474 ***	−3.362 ***
Decision	S	NS	S	S	S	S
Panel B: In first difference						
Constant	−6.085 ***	−4.795 ***	−5.606 ***	−4.432 ***	−5.092 ***	−5.589 ***
Constant and Trend	−6.265 ***	−4.946 ***	−5.761 ***	−4.543 ***	−5.216 ***	−5.734 ***
Decision	S	S	S	S	S	S

Note: *** represent significance at 1%.

Table 7. Unit root test with break.

Variables	In Level	In First Difference
Ke	-1.9×10^2 *** (1995)	-2.4×10^2 *** (2021)
Size	−85.779 *** (2021)	-1.4×10^2 *** (2021)
BMR	-1.5×10^2 *** (2021)	-2.3×10^2 *** (2021)
Beta	−25.416 *** (2000)	-1.5×10^2 *** (2021)
FL	−23.654 *** (1997)	-1.6×10^2 *** (2021)
ROE	−53.352 *** (2021)	-1.8×10^2 *** (2021)

Note: *** represent significance at 1%.

Table 8. Cointegration tests.

Tests	t-Statistic	Probability	Decision
Kao (1999)	−60.573	0.000	Cointegration
Pedroni (2004)	−107.764	0.000	Cointegration

4.2. Estimation and Interpretation

After examining the stationarity and cointegration tests, a set of robustness tests were performed. In fact, the results show that our panel is characterized by a serial autocorrelation problem (chi^2 (136) = 1712.999, *p*-value = 0.000), a heteroscedasticity problem (chi^2 (17) = 138.68, *p*-value = 0.000), and presents a cross-sectional dependency problem (Table 4). To address these issues effectively, the "Robust" command in Stata was utilized in conjunction with the Generalized Method of Moments (GMM) system approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998).

In addition, we examine diagnostic tests such as the Arellano and Bond (1991) autocorrelation test and the over-identification tests of Hansen (1982) to validate the estimation of this model.

The estimation established in Table 9 shows that the cost of equity capital decreases after IFRS adoption. In fact, the adoption reduces the cost of equity capital by 0.038, which is consistent with the findings of Prather-Kinsey et al. (2008), Daske et al. (2008), Armstrong et al. (2010), Li (2010), Palea (2013), Castillo Merino et al. (2014), Houqe et al. (2016), Persakis and Iatridis (2017), Utama et al. (2017), Wook-Bin and Yuk (2018), and De Moura

et al. (2020), who found that the IFRS Standards reduce the cost of equity capital. IFRS adoption has been beneficial to EU capital markets because it is associated with greater earnings and equity value relevance, increased information content, and lower cost of equity capital than before IFRS adoption. In addition, it improves the comparability of financial statements, which enhances the ability of users of financial statements to assess business performance. The improvement in disclosure and comparability of financial statements also reduces the cost of equity capital.

Table 9. Two-step GMM-system estimation.

Variables	Coefficient	Corrected Standard-Deviation	t-Statistic	Probability
Ke_{it-1}	−0.106	0.004	−28.92	0.000
$IFRS_{it}$	−0.038	0.012	−3.17	0.002
$Size_{it}$	0.014	0.004	3.21	0.001
BMR_{it}	0.0001	0.0002	0.52	0.603
$Beta_{it}$	0.006	0.003	1.78	0.077
FL_{it}	0.081	0.032	2.51	0.013
ROE_{it}	−0.001	0.0001	−2.68	0.008
Constant	−0.226	0.065	−3.46	0.001
AR(1) test		−1.42 (0.155)		
AR(2) test		−0.04 (0.967)		
Hansen test		23.510 (0.133)		

The regression analysis of European firms reveals that among the control variables, size (firm size) has a significant and positive coefficient (p-value = 0.001 < 1%), indicating that it has a significant effect on the increase in the cost of equity capital. This finding is consistent with the results of Reschiwati et al. (2020) and is explained by trade-off theory. According to this theory, larger firms can use more debt because they have lower bankruptcy risk. The bankruptcy risk for large firms translates into a lower cost of debt, which encourages them to use more debt. Therefore, firm size plays a crucial role in the cost of equity capital.

As expected, systematic risk (beta) had a positive and significant effect at the 10% level (p-value = 0.077 < 10%). This reveals that, as systemic risk increases, firms' cost of equity capital increases. Our results are consistent with those of Castillo Merino et al. (2014) and Houqe et al. (2016). Financial leverage (FL) also has a positive and significant effect at the 5% threshold (p-value = 0.013 < 5%) on the cost of equity capital in EU countries. This result was confirmed by Castillo Merino et al. (2014) and Persakis and Iatridis (2017).

This discount rate is an important element of corporate financial policy and influences the performance of capital markets because a slight variation in its value significantly affects the stock market value of a firm and its ability to create value. As expected, a firm's beta and leverage significantly and positively affect the cost of equity capital. Sharpe (1964) assumes that the higher the risk of a stock, the higher the return expected by investors. The estimation risk argument also affects leverage because a higher level of leverage increases the estimation risk of potential investors regarding the parameters of a stock's future returns.

The result for ROE shows a negative and significant relationship at the 1% level with the cost of equity capital in the EU countries (p-value = 0.008 < 1%). This result is confirmed by Ali Shah and Butt (2009), Khan (2016), and Faysal et al. (2021). Return on equity (ROE) (net income after tax/equity) measures a firm's return on equity. It was used as a control variable in the research on the relationship because of its impact on firm risk. Thus, the higher the ROE, the more comfortable investors are and the lower the risk. In theory, ROE is a profitability ratio that measures a company's ability to manage its sources of funds to increase revenues. If the ROE generated is high, it means that management has been able to

manage the existing capital as much as possible so that the profit generated is high, which should attract investors to invest in the company.

The diagnostic tests of the GMM-system method, as displayed in Table 9, indicate that the Arellano and Bond (1991) tests for AR(1) and AR(2) are not statistically significant. In addition, Hansen's (1982) test shows that the instruments are identified. Thus, these two tests for the GMM system estimation confirm the validity of this estimation.

European countries were early adopters of IFRS, especially after the European Union (EU) made it mandatory for listed companies to prepare their consolidated financial statements in accordance with IFRS since 2005. Many non-listed companies also choose to apply IFRS for their financial reporting due to the benefits of consistency, comparability, and global acceptance.

As a result of widespread IFRS adoption in Europe, investors and analysts are more familiar with the IFRS financial statements and reporting standards. This familiarity can lead to greater transparency and understanding of financial information, potentially reducing information asymmetry between companies and investors. Consequently, this can result in a reduction in the perceived risk by investors, leading to a lower cost of equity for European companies.

Non-European countries have also made significant progress in adopting IFRS; however, the extent of its adoption varies. Some countries have fully adopted IFRS for both listed and non-listed companies, while others may have adopted it only partially or for specific industries. In countries where IFRS adoption is limited, investors may face challenges in understanding and analyzing financial statements prepared using local accounting standards, especially if they are unfamiliar with those standards. This could result in increased uncertainty and perceived risk for investors, leading to a higher cost of equity for companies.

5. Conclusions and Policy Implications

This study examines the impact of IFRS adoption on the cost of equity capital of 337 firms listed in STOXX Europe 600, spanning 17 European countries, from 1994 to 2022. To estimate the cost of equity capital, the modified price–earnings–growth ratio model was employed, and the GMM-system technique suggested by Arellano and Bover (1995) and Blundell and Bond (1998) was used.

The findings reveal that IFRS adoption is negatively associated with European firms' cost of equity capital. In other words, IFRS adoption leads to a 0.038 reduction in the cost of equity capital. This implies that firms in European countries have benefited from a decrease in the cost of equity capital after IFRS adoption. This result supports the argument that high-quality accounting standards enhance the quality of financial reporting, which could positively affect firms' cost of equity capital, provided that adopting new accounting standards are implemented with a focus on improving a country's enforcement mechanisms. Thus, this result supports the hypothesis above.

After conducting a regression analysis, linking the estimated cost of equity capital of European firms to various control variables concerning accounting information, market influence, and mandatory IFRS adoption, we find compelling evidence regarding the impact of risk parameters (beta) on expected stock returns. Specifically, a firm's beta has a significant and positive effect on its cost of equity capital. An increase in a company's beta leads to a rise in its cost of equity capital, indicating higher perceived risk for investors and, consequently, a demand for increased returns to invest in the firm's stocks. Moreover, the study reveals that firms with higher leverage tend to possess a riskier profile, which leads investors to seek higher returns when investing in their stocks. The evidence consistently supports the idea that leverage not only positively influences the return on equity but also significantly affects the cost of equity capital for firms. This effect is attributed to the increase in the discount rate applied to future cash flows, thereby reducing the value of equity for investors.

After controlling for market beta and leverage, we find that—in contrast to Daske et al. (2008) and similar to the results of Li (2010), Castillo Merino et al. (2014), Houqe et al. (2016), and Persakis and Iatridis (2017)—the mandatory adoption of IFRS by European firms in 2005 led to a decrease in the cost of equity capital. Thus, improved financial disclosure quality and enforcement mechanisms have a significant and negative joint effect on the cost of equity capital of European stocks. This finding is relevant, as it suggests that a country-specific analysis with additional data for the post-adoption period is needed to capture and understand the economic consequences of mandatory IFRS adoption at the national level.

Thus, IFRS standards should be encouraged. Two key policy implications must be considered. First, European countries have to invest in Education and Training. Since IFRS adoption requires significant knowledge and expertise, the EU should invest in education and training programs to improve accounting professionals, investors, and other stakeholders' understanding and application of IFRS. Policymakers can prioritize developing high-quality training programs that cover the latest updates and changes in IFRS standards. By doing so, the EU can ensure that accounting professionals have the skills to implement IFRS effectively.

Second, European countries can harmonize their tax laws. In fact, the differences between EU countries' tax laws can create challenges in IFRS implementation. Policymakers can harmonize tax laws to ensure consistency and reduce the compliance burden on businesses. Harmonizing tax laws can also reduce the potential for tax-related distortions in financial reporting. This can increase investor confidence in financial statements and improve the comparability of financial information across the EU.

As in any research, our study has several perspectives. First, our findings rely on estimating the effect of IFRS disclosures in European countries. Future research could extend our study to other regions or countries, such as Asia and Africa. Second, our results show that IFRS adoption may be the only way to affect a firm's cost of equity capital and that there are many other potential factors in the literature that may have a larger impact than IFRS adoption, such as financial instruments and corporate governance. Third, future studies could explore how IFRS adoption affects equity costs in different economic sectors. Finally, further research on the implications of IFRS can be expanded and differentiated based on Europe countries, company dimensions, or business sectors. This approach would allow for a more comprehensive understanding of how IFRS impacts accounting and finance practices across different geographical regions, company sizes, and industry sectors.

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Does the Cultural Dimension Influence the Relationship between Firm Value and Board Gender Diversity in Saudi Arabia, Mediated by ESG Scoring?

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Abstract: The scarcity of female directors on Saudi boards is linked to cultural and social barriers deeply rooted in traditional masculine norms. Our study investigates the mediating role of ESG scores in the relationship between board gender diversity and firm value within the Saudi context. The Structural Equation Model (SEM) was utilized based on a sample of 54 Saudi-listed financial companies on (Tadawul) during 2021–2022. The study unveiled a negative correlation between female director presence and Saudi firm value. This association is attributed to the prevailing male-dominated Saudi societal norms, where boards with more female members may hesitate to prioritize performance-driven actions due to concerns about their perceived legitimacy within traditional gender roles. Conversely, a positive correlation was observed between female director presence and ESG scores, aligning with existing research highlighting the role of board gender diversity in improving sustainability performance. The sustainability framework prevails over the influence of gender diversity, fully integrating it within the broader context of sustainability to enhance the value of Saudi companies. Our results are consistent when considering alternative measures of firm value. Our findings offer valuable insights for investors assessing board gender diversity's impact on company value and emphasize the role of gender diversity in enhancing sustainability. They suggest that greater female representation on boards is vital for ESG score improvement, promoting sustainable initiatives and overall firm value. This calls for policymakers to promote sustainability disclosures and establish guidelines for increased female board participation, considering the absence of mandatory quotas.

Keywords: gender diversity; firm value; ESG disclosure; Saudi Arabia; masculinity—feminist cultural dimension

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1. Introduction

A broad stream of research has consistently affirmed the positive impact of gender diversity in corporate boards on firm value (e.g., Salem et al. 2019; Issa and Fang 2019; Dwaikat et al. 2021). Similarly, Wahab et al. (2018) suggest that boardroom homogeneity has adverse effects on firms. In addition, the presence of women on boards is widely acknowledged as a pivotal factor contributing to enhanced corporate social performance (Byron and Post 2016; Pucheta-Martínez et al. 2018). This inclusivity also correlates with more substantial corporate social responsibility ratings (Bear et al. 2010) and greater transparency in disclosing social and environmental initiatives (Cabeza-García et al. 2018). Accordingly, increased female representation on corporate boards fosters more democratic, social, and environmentally conscious organizations, resulting in improved environmental, social, and governance (ESG) scoring (del Mar Fuentes-Fuentes et al. 2023) while concurrently enhancing company value and optimizing economic returns (Jiang et al. 2021).

Gender diversity on corporate boards has garnered growing interest in academic circles due to its significant impact on company performance and value, which holds relevance for a diverse range of stakeholders, including policymakers and practitioners (EmadEldeen et al. 2021; Brahma et al. 2021; Eliwa et al. 2023). This facet of corporate governance is essential because it enhances corporate governance systems and the formulation of strategic decisions in the boardroom (Ullah et al. 2019). Past research draws on diverse psychological, cultural, and social theories to substantiate the implications of gender diversity on firm values (Lu et al. 2022; Eliwa et al. 2023). Within this context, cultural factors and societal pressures prompt companies to prioritize gender diversity within their boards. Simultaneously, the regulatory landscape differs across countries, with some nations mandating the inclusion of at least one woman on corporate boards, while this issue remains relatively unaddressed in others (Karamahmutoğlu and Kuzey 2016; Issa and Fang 2019). For instance, Aladwey et al. (2022) highlighted that in 2019, the UK Corporate Governance Code recommended that UK companies expand female representation on their corporate boards. Also, Norway has stipulated that a minimum of 40% of directors on corporate boards must be female (Eliwa et al. 2023). Accordingly, due to variations in institutional contexts across countries, influenced by cultural norms and corporate governance regulations, the impact of board gender diversity on firm value and CSR performance is likely to differ (Issa and Fang 2019).

The concept of "masculinity" is a socially constructed ideology that societies use to define the behaviors and attributes expected of men. In many cultures, there is a prevailing belief, particularly among women, that men occupy a dominant societal position. Men are discouraged from yielding, compromising, or displaying emotions, often perceived as signs of weakness. In contrast, femininity is often seen as the polar opposite of masculinity, associated with qualities such as compromise, surrender, and emotional expression, which are considered feminine and, therefore, weaker. As a result, masculinity represents the dominant authority of men, giving them more power and agency than women. Some scholars have argued that societies tend to uphold dominant social roles for men, granting them authority over women and other gender identities perceived as feminine (Nahshal 2019). Consequently, masculinity shapes and defines relationships within the framework of dominance, alliances, and subordination. In this way, masculinity becomes a hindrance to the progress of women, as they are often confined to roles defined by masculinity, hindering societal evolution (Dobash and Dobash 2003; Margolis et al. 2009; Flammer 2015).

The impact of gender diversity on corporate performance remains an underexplored area in the Middle East and North Africa MENA region countries like Saudi Arabia, where women's empowerment conditions are in a state of evolution, albeit at varying rates across countries due to the complex socioeconomic dynamics within the region (see, Al Hameli et al. 2023). The low number of female directors represented within the Saudi board (Chebbi and Ammer 2022), driven by cultural and social pressures, may contribute to such an end. Saudi Arabia is widely recognized as a patriarchal and masculine society. Men predominantly hold positions of power and exercise dominance over women, even in domains traditionally considered the domain of women. Men are expected to be the primary breadwinners, while women are traditionally assigned to manage the household, with men typically serving as the heads of their families (Mobaraki and Söderfeldt 2010). However, there are instances where men also take charge of household management. Women often find themselves in situations where they cannot express their opinions, perspectives, or emotions, and they may have limited mobility outside the boundaries of their homes. This dynamic has led to a significant power imbalance between men and women in Saudi society. Consequently, masculinity has a profound impact on the lack of empowerment of women in the Saudi workforce and has played a pivotal role in the virtual absence of women's roles in the workplace.

Saudi Arabia is demonstrating rapid economic growth, positioning itself as a prominent emerging economy regionally in the Middle East and globally. After the new 2030 Vision announcement in April 2016, the Saudi government made substantive changes to

increase women's representation in top managerial positions and certain divisions traditionally restricted to men (Almathami et al. 2020). To enhance female representation in the public domain, women were appointed to governmental positions and granted participation rights in the constrained political processes unfolding within Saudi Arabia (Karolak 2023). The government has also imposed further reforms, such as enforcing Saudi job quotas more rigorously than ever and incorporating positive discrimination in hiring women; otherwise, punishment is implemented (Boshnak et al. 2023). Therefore, it is necessary to investigate traditional notions of masculinity as a substantial role in gender diversity and its relationship with ESC score and firm value.

Accordingly, the implications mentioned above of the Saudi 2030 vision, accompanied by the contemporary economic reforms in Saudi Arabia, would enhance female participation and empowerment and would contribute to reshaping the cultural context in Saudi Arabia from masculine-dominated to a notion of board diversity and equality. While this initiative anticipates bolstering Saudi Arabia's economic well-being through heightened female workforce participation, empirical research to assess the efficacy and achievement of Vision 2030's objectives in enhancing women's involvement needs to be improved (Almathami et al. 2020). In addition, Almubarak et al. (2023) issued a call for research papers that explore the interplay between corporate governance variables and the dynamics of ESG in conjunction with various factors, encompassing the benefits of sustainable management and gender diversity considerations. Thus, the study sheds light on an unexplored area within the relevant literature: the examination of board gender diversity in Saudi Arabia and its potential impact on corporate performance. Accordingly, it is interesting to gain deeper insights into gender diversity in the ever-changing cultural and social environment. Thus, our paper aims to study the effect of board gender diversity on firm value in Saudi Arabia and how the ESG scoring would mediate such an effect subject to the reshaped cultural dimension. The aim of our paper is to test the mediating effect of ESG scoring as a proxy for the sustainability performance on the relationship between gender diversity and firm value, taking into account the cultural dimension of Saudi Arabia. Utilizing structural equation modeling (SEM), a well-established inferential framework for mediation analyses, we examine a sample of 54 Saudi financial companies listed on the Saudi Stock Exchange (Tadawul) from 2021 to 2022, resulting in 108 firm-year observations.

The findings unveil a negative association between female directors' presence and Saudi firms' value. This relationship can be attributed to Saudi Arabia's predominantly male-dominated society, where a corporate board with a higher proportion of female members may be less willing to adhere to the notion of thinking that prioritizes objective and performance-oriented attitudes and actions that might diminish their perceived legitimacy. Accordingly, the prevalence of traditional masculinity in society may dampen the positive influence of board diversity on a company's performance. Furthermore, the findings suggest a correlation between the participation of female directors on Saudi corporate boards and enhancements in companies' ESG scores, serving as a proxy for their sustainable performance and disclosure. This finding is consistent with a substantial body of research that underscores the crucial role of board gender diversity in improving a company's sustainability performance. Notably, ESG acts as a comprehensive mediator, effectively channeling the intended impact of board gender diversity in promoting the value of Saudi companies. In essence, the sustainability framework takes precedence, outweighing the influence of board gender diversity in enhancing a company's value, as gender diversity is fully integrated within the sustainability context.

Our paper contributes to the pertinent literature in many aspects as follows: First, it sheds light on one of the uncharted areas in the pertinent literature, the board gender diversity in Saudi Arabia and its implications on the value of Saudi firms. Second, although the cultural and social barriers to women's participation in Saudi boards still matter, our paper provides empirical evidence that the potential of female directors in enhancing Saudi firms' value is fully mediated within sustainability initiatives. Thus, our study emphasizes that diverse cultural contexts influence the expected positive outcomes of gender diversity

within corporate boards, which, in turn, contributes to the realization of firm value. Third, it underscores the notion that the pathways to attaining sustainability goals also facilitate the promotion of gender equality and diversity in a fast-moving Saudi business environment.

The remaining sections of the paper proceed as follows. In Section 2, we delve into the institutional context, review the relevant literature, and outline the development of hypotheses. Section 3 provides an overview of the methodology, including details about the sample, data, and models utilized. Proceeding to Section 4, we present descriptive statistics and the primary findings of our study. Section 5 is dedicated to additional tests conducted in our research. Finally, Section 6 offers our conclusions, implications, and recommendations for future research directions.

2. Background, Literature Review, and Hypotheses Development

2.1. Gender Diversity and ESG Score in Saudi Arabia

A growing emphasis on gender diversity has also had regulatory implications. Governments and regulators are paying increasing attention to female participation in businesses; depending on where they operate, companies may face even more regulatory pressure to address gender diversity at the board level and beyond (S&P Global 2020). For example, in U.S., California's law requiring certain publicly traded companies to include women on their boards will more than double the total number of female-held board seats in the state. Other U.S. state governments, including New Jersey, Illinois, and Massachusetts, have taken efforts to introduce similar legislation related to gender diversity on boards of directors (S&P Global 2020).

In the Saudi context, amid global requests to enhance environmental, social, and governance investments, the Saudi government in Saudi Arabia wants an improved approach that combines ESG demand with today's challenging economic reality[1] The GDP in Saudi Arabia has historically been heavily influenced by oil exports. Nevertheless, due to the volatility and instability in oil prices during the past decade, Crown Prince Mohammed bin Salman, acting on behalf of the Saudi government, introduced the Saudi Vision 2030 framework on 25 April 2016 (Boshnak et al. 2023). The Saudi Vision of 2030[2] prioritizes the adoption of essential fiscal amendments that enhance Saudi Arabia's economic sustainability in the long run. In 2021, the Saudi Stock Exchange[3] announced ESG disclosure standards, which will assist listed businesses and potential corporations intending to go public with their ESG reporting and promote awareness in the local market. According to the ESG Disclosure Guidelines released by the Saudi exchange[4], the sustainable growth is the pivot of the Vision 2030, and its underlying principles enhance the formulation and execution of Vision 2030 that are in alignment with the chief tenets of ESG practices. This alignment justifies the reason behind the Saudi exchange's empowerment toward ESC discourse in the capital market. In addition, in 2018[5], the Saudi Stock Exchange entered a partnership with the UN Sustainable Stock Exchanges Initiative. This collaboration aimed to enhance the ESG awareness initiatives and promote sustainable investment practices.

Furthermore, as noted by Nahshal (2019), one of the fundamental goals embedded in Vision 2030 is the enhancement of women's empowerment in Saudi Arabia. In 2019, Saudi Arabia achieved a remarkable surge in its ranking in the World Bank Group's Women, Business, and the Law report[6]. This upswing surpassed that of all other countries when compared to its 2018 ranking. Additionally, the International Finance Corporation (IFC) released a report in 2022 on gender equality in corporate leadership among G20 nations[7], revealing an increase in the percentage of women holding board seats in Saudi Arabia in 2022. This substantial progress can be attributed to Saudi Arabia's adoption of an extensive range of measures aimed at expanding women's roles in society and granting them unprecedented economic freedoms (Karolak 2023).

Consequently, women's contributions in Saudi Arabia are now not only expected but also acknowledged. However, a persisting challenge that necessitates cultural adjustments for resolution is the entrenched perceptions of gender roles in a predominantly male-dominated field (Chebbi and Ammer 2022). Despite the persisting issues related to

masculinity in the country, Saudi female empowerment is gradually reshaping societal norms and challenging the status quo. This evolving landscape is indicative of a growing movement toward achieving genuine gender equality (Nahshal 2019).

2.2. Hypothesis Development

Table 1 summarizes the previous research related to our main variables as follows.

Table 1. A summary of the prior research.

Research Variables	Author	Findings
Board gender diversity and firm value.	Salem et al. (2019); Issa and Fang (2019); Dwaikat et al. (2021)	- Demonstrated the capacity of female board directors to elevate a company's overall value.
	Agyemang-Mintah and Schadewitz (2019)	- Noted that financial institutions benefit from the presence of female directors by witnessing an increase in their value.
	Noguera (2020)	- Emphasized the positive correlation between female directors and the value of real estate investment trusts.
	Bagh et al. (2023)	- Revealed a positive association between board diversity and company value.
	Alhosani and Nobanee (2023)	- Stated that gender diversity in corporate boards has an impact on firm value.
Board gender diversity, firm value, and firm performance.	Terjesen et al. (2015)	- Found women directors elevate board performance through their problem-solving acumen and creativity, ultimately contributing to increased business value.
Board gender diversity and ESG performance.	Cabeza-García et al. (2018)	- Found gender diversity within corporate boards can contribute to the firm's social and environmental performance.
	Byron and Post (2016)	- The presence of women on corporate boards has been associated with elevated levels of corporate social performance.
	Bear et al. (2010)	- Gender diversity within corporate boards can contribute to stronger corporate social responsibility ratings.
	Cabeza-García et al. (2018)	- The presence of women on corporate boards increased disclosure of social and environmental practices.
	Aladwey et al. (2022)	- Observed that female directors tend to exhibit higher levels of responsibility, which can motivate companies to disclose information related to their social and environmental initiatives.
	Rao and Tilt (2016); Yasser et al. (2017); Harjoto and Laksmana (2018)	- State the influential role of female directors in shaping social and environmental reporting.
	Pucheta-Martínez et al. (2018)	- Discovered a positive correlation between the presence of external women directors (both independent and institutional) and CSR disclosure.
	Flammer (2015); Margolis et al. (2009); Donaldson and Preston (1995)	- Company's commitment to social and environmental responsibility contribute to its competitive advantage, ultimately enhancing its performance and value.
ESG performance and firm value.	Alodat et al. (2023)	- Found that CSR disclosure have potential to increase firm value and maximize economic return.
Board gender diversity, firm value, and ESG performance.	Ahern and Dittmar (2012); Matsa and Miller (2013)	- Demonstrated that gender diversity has no significant effect on firm-related outcomes, including the ESG score.
	Escamilla-Solano et al. (2023)	- Women directors have multiple positive effects on firm-related outcomes and values, primarily in terms of improving the ESG score and promoting ethical behaviour.
	Wang et al. (2023)	- The mediating role of the ESG score in the relationship between gender diversity and firm value can be expected to differ based on the specific country and its context.

2.2.1. The Relationship between Gender Diversity and Firm Value

Board gender diversity has emerged as a pivotal component within corporate governance. Its significance lies in its capacity to enhance the corporate governance system and influence the strategic decisions formulated in the boardroom. Women occupying senior management positions, particularly on boards, contribute a unique set of experiences and

perspectives that fortify the governance function of the board. This, in turn, can bolster decision-making processes and yield positive impacts on corporate value.

A body of previous research has established a strong relationship between the presence of women on corporate boards and enhanced business value. Notably, studies conducted by Salem et al. (2019), Issa and Fang (2019), and Dwaikat et al. (2021) have all demonstrated the capacity of female board directors to elevate a company's overall value. Agyemang-Mintah and Schadewitz (2019) further noted that financial institutions benefit from the presence of female directors by witnessing an increase in their value. Additionally, Noguera (2020) emphasized the positive correlation between female directors and the value of real estate investment trusts, highlighting women's potential to serve as skilled director candidates who enhance market awareness within the industry. Moreover, women directors have been found to elevate board performance through their problem-solving acumen and creativity, ultimately contributing to increased business value (Terjesen et al. 2015). In a similar vein, Bagh et al. (2023) revealed a positive association between board diversity and company value. This connection is attributed to the diverse and distinct characteristics of board members, which facilitate the formulation of high-quality decisions.

As mentioned earlier, Saudi's Vision 2030 opens the door for female participation and empowerment. As argued by Nahshal (2019), this embraced vision has led to what can be described as a "Golden Age" for women in Saudi Arabia, ushering in a significant wave of cultural transformation, especially regarding traditional gender roles. This notion of thinking marks a significant departure from traditional norms where gender segregation hindered women from realizing their full potential, and their empowerment was viewed as unnecessary to achieve economic development (Karolak 2023). Accordingly, based on the context of Saudi Arabia, we hypothesize the following:

H1: *There is a positive association between board gender diversity and firm values.*

2.2.2. The Relationship between Gender Diversity and ESG Score

As social and environmental issues become more pressing, ESG and sustainable investment have become important. Furthermore, gender diversity is a social quality that investors value, and it is a metric businesses are eager to promote. Investors are becoming more aware of the need to resolve environmental, social, and governance (ESG) issues, putting pressure on public companies to perform well in all three areas. As a result, investors are urging firms to diversify their boards of directors and to perform gender diversity and equality audits to determine how they will respond to ESG risks and opportunities (S&P Global 2020). As a result, gender diversity has become an essential aspect of the ESG's identity (Burdon 2023). Gender diversity serves to reinforce and promote ESG investing and companies who make an effort to do so. As expected, companies that have previously adopted gender diversity have experienced numerous advantages. Gender diversity, for example, is a significant feature for integrating enterprises into ESG funds. Aside from that, rating agencies evaluate gender diversity while evaluating their "S" score. When a company performs well in all three categories (environmental, social, and governance), it has a significantly better chance of being included in ESG-focused investing strategies (Burdon 2023).

Prior research has increasingly centered on the interconnection between corporate governance and sustainability. In this context, corporate governance and ESG disclosure are inherently intertwined, reflecting a company's engagement with its internal and external socio-political environment. Notably, gender diversity within corporate boards has emerged as a pivotal aspect of corporate governance, providing valuable resources such as personal networks, knowledge, and ethical principles that can contribute to the firm's social and environmental performance (Cabeza-García et al. 2018).

As a result, the presence of women on corporate boards has been associated with elevated levels of corporate social performance (Byron and Post 2016; Pucheta-Martínez et al. 2018), more substantial corporate social responsibility ratings (Bear et al. 2010), and

increased disclosure of social and environmental practices (Cabeza-García et al. 2018). Including more women on corporate boards fosters greater democratic, socially engaged, and ecologically responsible corporate practices, thereby improving social and environmental standards. Moreover, Aladwey et al. (2022) observed that female directors exhibit higher levels of responsibility, which can motivate companies to disclose information related to their social and environmental initiatives. This view is supported by Rao and Tilt (2016), Yasser et al. (2017), and Harjoto and Laksmana (2018), which underscores the influential role of female directors in shaping social and environmental reporting. Furthermore, Pucheta-Martínez et al. (2018) discovered a positive correlation between external women directors (independent and institutional) and CSR disclosure.

Subject to the Saudi context, Karolak (2023) argued that to increase women's participation in the public sphere, women were appointed to governmental positions and granted opportunities to engage in the limited political processes in Saudi Arabia. Accordingly, in light of the evidence indicating that the inclusion of female directors on corporate boards enhances social and environmental disclosure, our research proposes the following hypothesis:

H2: *There is a positive association between gender diversity and ESG score.*

2.2.3. The Relationship between Gender Diversity and Firm Value: The Mediating Effect of ESG Disclosure

The benefits of a company's commitment to social and environmental responsibility contribute to its competitive advantage, ultimately enhancing its performance and value (Donaldson and Preston 1995; Margolis et al. 2009; Flammer 2015). Companies prioritizing sustainability disclosure can increase their value and maximize economic returns (Alodat et al. 2023). Furthermore, firms with greater gender diversity on their boards tend to be more engaged in reporting on social and environmental issues (Aladwey et al. 2022). Altering the composition of corporate boards by increasing female representation can enhance board performance because diverse boards often bring a more comprehensive perspective. However, the impact of gender diversity on corporate boards and its connection to firm value can vary significantly depending on the context and country (Alhosani and Nobanee 2023).

In the context of Hofstede's cultural dimensions, the "masculinity-femininity" dimension can influence board gender diversity, firm performance, and value. This cultural dimension may either support or resist board diversity. For instance, masculinity in organizational culture emphasizes achievement, assertiveness, and material rewards for success. In nations characterized by a pronounced masculinity within their organizational culture, corporate boards often exhibit more significant gender differentiation, with a predominant emphasis on objectives among board members (Kabir et al. 2023). In contrast, a more feminine culture promotes gender equality, and board members tend to be more compromising and collaborative. In such cultures, women on boards often focus on non-monetary contributions and foster cooperative relationships, emphasizing relationships over objectives (Luckerath-Rovers 2013).

Due to variations in institutional contexts across countries driven by cultural differences (Post and Byron 2015), the mediating role of the ESG score in the relationship between gender diversity and firm value can be expected to differ based on the specific country and its context. Some scholars argue that appointing women directors to the board has multiple positive effects on firm-related outcomes and values, primarily in terms of improving the ESG score and promoting ethical behavior (Pucheta-Martínez et al. 2018; Escamilla-Solano et al. 2023). However, other authors suggest that gender diversity does not significantly affect firm-related outcomes, including the ESG score (Ahern and Dittmar 2012; Matsa and Miller 2013). Given these inconsistent findings, we hypothesize that the ESG score mediates the relationship between gender diversity and firm value in the context of Saudi Arabia. This hypothesis can be formulated as follows:

H3: *ESG disclosure mediates the relationship between gender diversity and firm value.*

Figure 1 depicts the impact of BGD on FV, as indicated by path (c′), mediated through the role of ESG, represented by paths (a) and (b). As illustrated in Panel A, Figure 1, path (c) signifies the direct influence of BGD on FV. The inclusion of mediating variables leads to the breakdown of the total effect (c) of BGD on FV into a direct effect (c′) and an indirect effect (ab), as presented in Panel B, Figure 1.

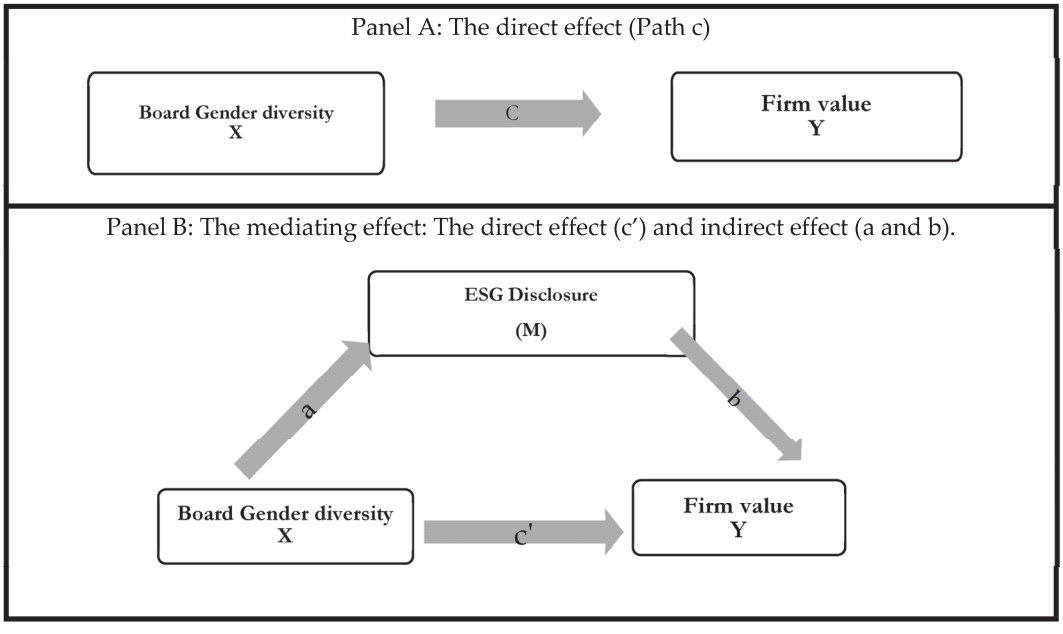

Figure 1. Board gender diversity and firm value: the mediating effect of ESG disclosure.

3. Methodology

3.1. Sample and Data

To assess the mediating impact of ESG discourse on the relationship between gender diversity and firm value, we conducted our analysis using a sample comprising financial Saudi companies listed on the Saudi Stock Exchange (Tadawul). Our sample comprises a diverse range of financial Saudi-listed firms across various sectors, including banks, diversified financials, REITs, and insurance. Furthermore, the dataset encompasses data for the years 2021 and 2022, representing the most recent available information. As argued by Shen et al. (2020) and Sultana et al. (2022), the global COVID-19 pandemic substantially dampened economic activities worldwide. Accordingly, we could not extend our analysis to a broader timeframe preceding the mentioned period due to the evident impact of the COVID-19 pandemic on financial data. The sampling process and categorization of firms based on their respective industrial sectors are presented in Table 2. After the exclusion of companies with no or insufficient data about the variables under investigation, our final sample consisted of 54 companies with 108 company-year observations.

Data about the variables under investigation were collected from different sources. We manually collected the data regarding the financial variables from the Saudi Stock Exchange' Tadawul' website. In addition, the ESG score was obtained from the Refinitiv Thomson Reuters Database. Finally, data for gender diversity were manually collected from companies' annual reports, governance reports, and official websites. Following Gonçalves et al. (2022), all continuous variables were winsorized at 1% to reduce the influence of outliers.

Table 2. The sample: selection process and industry sectors.

Panel I: Sample Selection Process					
Description				**2021**	**2022**
Financial Saudi-listed companies (initial sample)				62	62
Less, Companies with missing financial/or governance data				8	8
Total				54	54
Firm-Year Observations				108	
Panel II: Sample according to the industrial sectors					
Description	**Banks**	**Diversified Financials**	**REITs**	**Insurance**	**Total**
No. of Obs.	22	10	24	52	108
Percentage	20.37	9.26	22.22	48.15	100%

3.2. Measurement of Variables

Table 3 shows the definition of the main variables utilized. The independent variable in our study pertains to gender diversity (BGD), represented as a binary dummy variable. Specifically, it takes the value of one if the board of directors includes at least one female director and zero otherwise (Chebbi and Ammer 2022). As for our dependent variable, firm value (FV), it is operationalized as the market-to-book value ratio (Bravo 2017; Abdi et al. 2022; Ben Fatma and Chouaibi 2021). This ratio is calculated by dividing the market capitalization of equity by its book value. According to Abdi et al. (2022) and Ben Fatma and Chouaibi (2021), a ratio of less than one signifies that the market price of equity falls below the book value, which may imply financial distress for companies. Conversely, when the ratio exceeds one, the market price surpasses the book value of a company's assets, suggesting sustained profitability and strong financial performance (Abdi et al. 2022; Ben Fatma and Chouaibi 2021).

Our paper employed the ESG score as the mediating variable to assess a company's sustainability and disclosure performance. The ESG score, sourced from the Refinitiv Thomson Reuters Database, is depicted on a scale ranging from 0% to 100%. As illustrated in Table 4, this scoring system encompasses four tiers—A, B, C, and D—reflecting the quality of sustainability performance and disclosure.

We employed two sets of control variables in our study. The first set comprises corporate governance variables: board independence (BI) and board size (BS). Board independence (BI) is determined as the percentage of independent directors on the board (Aladwey and Diab 2023). Consistent with Kiharo and Kariuki (2018), board independence is argued to have a positive association with firm value. Independent directors are considered more adept at overseeing management actions that enhance the transparency of financial reporting and thus enhance a firms' value (Kiharo and Kariuki 2018). Additionally, board size (BS) is calculated as the natural logarithm of the number of board members (Ben Fatma and Chouaibi 2021; Aladwey and Diab 2023). Following the rationale proposed by Noja et al. (2021), we predict a positive relationship between board size and firm value in the context of financial sectors.

The firm-specific variables, our second set of control variables, encompass company size (FS), age (AGE), and leverage (LEV). Firm size (FS) is computed as the natural logarithm of total assets (Aladwey 2021). Firm age (AGE) is calculated as the natural logarithm of the number of years a company has been in the market since its incorporation (Martínez-Ferrero et al. 2020; Fayyaz et al. 2023; Alodat et al. 2023). Finally, following Biswas et al. (2023), the leverage (LEV) is computed as total liabilities divided by total assets. Ben Fatma and Chouaibi (2021) argue that in the context of financial institutions, there is a non-significant association between firm value and leverage.

Table 3. Definition of variables.

Variable	Definition	Authors
The independent variable: board gender diversity (BGD)	A dummy variable that equals to one if the boards contain at least one female director, and zero otherwise.	Alodat et al. (2023); Chebbi and Ammer (2022); Biswas et al. (2023)
The dependent variable: firm value (FV)	It is calculated as the market-to-book value.	Bravo (2017); Abdi et al. (2022); Ben Fatma and Chouaibi (2021)
The mediating variable: environmental, social and governance score (ESG)	It represents the ESG score as presented by Refinitiv Thomson Reuters Database.	Chebbi and Ammer (2022)
Control Variables		
Board independence (BI)	It is calculated as the number of independent directors deflated by the number of the board size.	Aladwey and Diab (2023)
Board size (BS)	It is operationalized as the natural logarithm of the number of directors in a board.	Ben Fatma and Chouaibi (2021); Aladwey and Diab (2023)
Firm size (FS)	It is calculated as the natural logarithm of total assets.	Aladwey (2021)
Firm age (AGE)	It is operationalized as the natural logarithm of number of years for a company since incorporation	Martínez-Ferrero et al. (2020); Alodat et al. (2023); Fayyaz et al. (2023)
Firm leverage (LEV)	It is computed as total liability deflated by total assets at year-end	Biswas et al. (2023)

Table 4. The categories of ESG based on Refinitiv Thomson Reuters Database[8].

Grade	Score	Description
The A's level, also referred to as "ESG leaders"	$0.75 < \text{score} \leq 1$	It represents companies that are highly superior in conducting and disclosing sustainable performance.
The B's level	$0.50 < \text{score} \leq 0.75$	Companies with B' score demonstrates a relatively higher ESG performance and show an above-average degree of transparency in sustainability disclosure.
The C's level.	$0.25 < \text{score} \leq 0.50$	It shows an acceptable score relating to companies' ESG performance and disclosure.
The D's level, also known as "ESG laggards"	$0 \leq \text{score} \leq 0.25$	It shows companies with poor sustainable performance and disclosure.

3.3. Model

In order to test the mediating effect of ESG disclosure on the relationship between gender diversity and firm value, we utilize two approaches. First, we follow Baron and Kenny's (1986) approach to mediation—the variable functions as a mediator when it satisfies the following criteria. First, the independent variable should significantly affect the mediator, "path a." Second, the dependent variable should significantly explain the change in the mediator variable, "path b." Third, upon controlling the results in both paths a and b, the alluded significant relationship between the independent and dependent variables becomes non-significant. Accordingly, the powerful demonstration of mediation happens in "path c": the direct relationship between the independent and dependent variables decreases after controlling the effect of mediators Baron and Kenny (1986).

In our paper, we have three variables. The firm value represents the independent variable or Y; gender diversity is the dependent variable or X; and the ESG disclosure is

the mediating variable or M. Following Salhi et al. (2020) and Alodat et al. (2023), we operationalized the mediation effect into four steps as follows.

Step one: Identify the relationship between Y and X.

Step two: Identify the relationship between M and X.

Step three: Identify how M affects the alluded relationship between Y and X.

Step four: Indicate if M fully mediates the X and Y relationship in the case that the direct effect of X on Y is diminished upon controlling M (path c').

Second, in line with Salhi et al. (2020) and Abu-Bader and Jones (2021), Sobel tests were employed to examine whether a third variable (M) mediates the relationship between the independent variable (X) and the dependent variable (Y). Consistent with Jarboui et al. (2020) and Alodat et al. (2023), the complete mediation model was confirmed when the significance of X diminished after accounting for M, while partial mediation was established if X remained significant even after controlling for M.

Structural equation modelling (SEM), in contrast to traditional regression analysis, is a robust inference framework for mediation analyses capable of handling concurrent indirect and direct effects and acknowledging the mediator's dual role as both a cause and an effect (Gunzler et al. 2013). Accordingly, similar to Salhi et al. (2020) and Moussa et al. (2023), we employed SEM to explore the direct and indirect associations between board gender diversity and firm value in econometric models 1 to 3, where steps three and four were integrated into model three as follows:

$$FV_{it} = \beta_0 + \beta_1\, BGD_{it} + \beta_2\, BI_{it} + \beta_3\, BS_{it} + \beta_4\, FS_{it} + \beta_5\, AGE_{it} + \beta_6\, LEV_{it} + FIRM\ and\ YEAR\ Fixed\ effect + \varepsilon_{it} \quad (1)$$

$$ESG_{it} = \beta_0 + \beta_1\, BGD_{it} + \beta_2\, BI_{it} + \beta_3\, BS_{it} + \beta_4\, FS_{it} + \beta_5\, AGE_{it} + \beta_6\, LEV_{it} + FIRM\ and\ YEAR\ Fixed\ effect + \varepsilon_{it} \quad (2)$$

$$FV_{it} = \beta_0 + \beta_1\, BGD_{it} + \beta_2\, ESG_{it} + \beta_3\, BI_{it} + \beta_4\, BS_{it} + \beta_5\, FS_{it} + \beta_6\, AGE_{it} + \beta_7\, LEV_{it} + FIRM\ and\ YEAR\ Fixed\ effect + \varepsilon_{it} \quad (3)$$

4. Analysis and Results

4.1. Descriptive Analysis

Table 5 shows the descriptive statistics for the utilized continuous variables (mean, standard deviations, minimum, median, and maximum values. The FV, or the market-to-book ratio, spans a wide range from 0 to 4.45, with an average value of 1.25., revealing a diverse landscape within the financial sector of Saudi Arabia. Some companies are traded at or below their book value, while others command a premium, with the market valuing them substantially higher than their book value. The mean value of ESG is 12.69, with a standard deviation of 20.72, signifying significant variations in the disclosed ESG information across the sample. Consequently, ESG scores within the Saudi financial sector span a broad spectrum. The scale spans from 0, denoting companies with insufficient evidence of sustainable practices and disclosure, to a high ESG score of 73, signifying companies demonstrating relatively robust sustainable performance and highly transparent sustainability disclosure. On average, the percentage of independent directors within the Saudi boards is 40, and the number of board members is around three directors. Additionally, the mean size of Saudi financial listed companies is 20, and the average age is two years. Within the list of financial companies in Saudi Arabia, the leverage ratios exhibit significant variation, ranging from notably low levels (0.21) in some cases to exceptionally high levels (11.6) in others.

Table 6 provides statistical insights into gender diversity and ESG scores in Saudi Arabia, with a breakdown by industry sector. By the ESG score tiers detailed in Table 4, it is notable that no companies within the Saudi financial sector are categorized as "A," signifying a high level of excellence in sustainable performance and disclosure, as indicated in Table 6. Within the financial sector, the banking sector leads with 19 percent of companies adhering to sustainability standards, surpassing other financial sectors. In contrast, the diversified financial and REITS sectors exhibit relatively lower percentages, with 2% and

4% of companies acknowledged by Refinitiv Thomson Reuters for their commitment to sustainability practices. Table 6 demonstrates the percentage of female directors on the boards of various financial sectors. The diversified financial sector stands out with the highest representation of female directors at 60 percent, while the insurance sector records the lowest percentage with only 8 percent.

Table 5. Descriptive statistics for continuous variables.

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Firm value (FV)	108	1.25	1.13	1.18	0.00	4.45
ESG	108	12.69	0.00	20.72	0.00	72.95
Board independence (BI)	108	0.40	0.37	0.16	0.00	0.83
Board size (BS)	108	2.99	2.07	0.36	1.10	4.64
Firm size (FS)	108	19.94	20.61	2.33	12.89	23.41
Firm age (AGE)	108	1.78	1.15	0.37	0.48	1.83
Leverage (LEV)	108	5.59	1.38	7.67	0.21	11.64

Table 6. Summary statistics for gender diversity and ESG scores in KSA subject to industry sector.

		Industry Sector				
		Banks	Diversified Financials	REITs	Insurance	Total
ESG	D	6	0	0	3	9
	C	5	2	0	7	14
	B	9	0	0	2	11
	A	0	0	0	0	74
Total		20	2	4	12	108
Percent		19	2	4	11	100
BGD Percent	0	64	40	75	92	78
	1	36	60	25	8	22
Total						100

4.2. Correlation Matrix

Table 7 shows the statistical results of the Pearson correlation and multicollinearity. The Pearson correlation matrix is typically used to illustrate the correlation between continuous variables when they exhibit a normal distribution pattern (Schober et al. 2018). In line with the guidelines of Schober et al. (2018), correlation coefficients below 0.40 indicate weak or no correlations among variables, which is the case for the correlation coefficients of all the continuous variables presented in Table 7, Panel A. Subsequently, according to Chebbi and Ammer (2022), the VIF values that are below the critical threshold of 10 imply the absence of multicollinearity concerns. As observed in Table 7, Panel B, we can conclude that our variables have no multicollinearity problem.

Table 7. Pearson correlation and multicollinearity statistics.

	Panel A: Pearson Correlation							Panel B: Multicollinearity Statistics	
Variables	**FV**	**ESG**	**BI**	**BS**	**FS**	**AGE**	**LEV**	**VIF**	**1/VIF**
Firm value (FV)	1.000							1.85	0.539
ESG	−0.316 *	1.000						1.44	0.694
Board independence (BI)	0.380 *	−0.130	1.000					1.11	0.905
Board size (BS)	−0.299 *	0.488 *	−0.124	1.000				1.76	0.569
Firm size (FS)	0.596 *	0.001	0.135	−0.146	1.000			1.14	0.837
Firm age (AGE)	−0.174	0.454 *	0.039	0.595 *	−0.137	1.000		1.69	0.592
Leverage (LEV)	−0.141	−0.150	0.010	−0.092	−0.313 *	−0.075	1.000	1.17	0.855

* $p < 0.1$.

4.3. Primary Findings of SEM

Table 8 displays the fixed effect regression results. Similar to Chebbi and Ammer (2022) and Alodat et al. (2023), in order to mitigate the influence of unaccounted variables and potential biases, we incorporated fixed effects regression in our models. As presented in Table 8, the results of the Hausman tests are statistically significant, suggesting the superiority of the fixed effect model for our analysis. Wooldridge (2013) and Brüderl and Ludwig (2015) state that fixed effects regression can lead to biased estimates when independent variables exhibit substantial variation across different firms. However, if there is consistency within the same firm over time, the firm-specific heterogeneity may not disrupt the estimation process, thereby enabling the fixed effect model to yield unbiased estimates (Brüderl and Ludwig 2015; Nasr and Ntim 2018).

Table 8. Results of the main regression analysis for the mediation.

	Model 1 (FV)		**Model 2 (ESG)**		**Model 3 (FV)**	
	Coef.	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
Firm value (FV)	−0.122 *	0.078	0.222 ***	0.001	0.064	0.765
ESG					0.016 ***	0.002
Board independence (BI)	1.035 ***	0.000	−7.803	0.466		
Board size (BS)	−0.509 **	0.050	0.695 ***	0.005		
Firm size (FS)	0.246 ***	0.000	1.086	0.161		
Firm age (AGE)	−0.011	0.970	0.968 ***	0.005		
Leverage (LEV)	−0.000	0.973	−0.037	0.708		
Constant	−2.650 ***	0.001	−60.760 ***	0.003	−4.612 ***	0.000
R-squared	0.463		0.374		0.512	
Firm and year effect	Yes		Yes		Yes	
Hausman test	18.24 ***		3.80 *		22.61 ***	
N-Obs	108		108		108	
Sobel						0.022
Aroian						0.025
Goodman						0.019

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.1. Estimating the Direct Relationship between Board Gender Diversity and Firm Value

Step one involves discerning the correlation between board gender diversity (X) and firm value (Y). Contrary to our expectation, the findings of Table 8, Model 1, indicate a negative relationship between board gender diversity (BGD) and firm value (FV) at a 10% significance level, as evidenced by a p-value of 0.058 and β_1 of -0.122. Accordingly, H1 is not supported. This finding is in congruence with Anh and Khanh (2017), Naghavi et al. (2021), and Kabir et al. (2023), which have also reported a negative association.

In contrast to the prevailing literature, which predominantly supports a positive association, our findings seem a better fit within the specific context of Saudi Arabia. This is especially pertinent given the limited involvement of female directors on the boards within the Saudi financial sector, as indicated in Table 4. Thompson (2019) highlights the widespread recognition of socio-cultural norms shaping accepted societal norms in Saudi Arabia. Nahshal (2019) further emphasizes the prevalence of a masculine cultural norm in Saudi Arabia, which is influenced by factors like upbringing, socialization, and parenting, which leads to distinct roles for men and women. Consequently, Saudi Arabia is commonly characterized as a masculine state where women face restrictions in various areas (Al-Rasheed 2013; Nahshal 2019).

Hofstede's cultural dimensions, precisely the "masculinity-femininity" dimension, are recognized to notably influence firm performance (Kabir et al. 2023). In general, masculine societies tend to be more competitive and goal-oriented than feminine cultures, where a greater emphasis is placed on nurturing interpersonal relationships and fostering socially oriented objectives (Naghavi et al. 2021; Kabir et al. 2023). Therefore, in a highly masculine society, a board of directors with a higher proportion of female members may be less inclined toward conforming to norms emphasizing assertive and performance-based corporate actions, potentially reducing their targeted legitimacy (Naghavi et al. 2021). In essence, this suggests that the prevalence of masculinity in society may reduce the positive impact of board diversity on a company's performance.

Regarding the control variables, Table 8 reports that BI is positively associated with FV at a significance level of 1% where p-value = 0.000 and β_2 = 1.035. This result aligns with the findings of Kabir et al. (2023). In essence, the higher the proportion of independent directors on the boards of Saudi financial companies, the greater the value of these companies. This aligns with the expectations outlined by Singh et al. (2017) and Kapoor and Goel (2019), who anticipate that independent directors will diligently oversee management actions, mitigate bias, and act in ways that enhance the value of their companies. Table 8 also indicates a negative association between BS and FV at a significance threshold of 5% (where p-value = 0.05 and $\beta_3 = -0.509$). Consistently, Kumar and Singh (2013) and Nguyen et al. (2016) assume that firms with large board sizes are expected to demonstrate lower operating performance while incurring higher operating costs. For firm-specific variables, Table 8 indicates a positive association between FS and FV at a significance level of 1% (p-value = 0.00 and β_4 = 0.246). Conversely, non-significant associations are reported between FS and either AGE or LEV.

4.3.2. Estimating the Relationship between Board Gender Diversity and ESG Disclosure

In the second step, the examination tested the association between board gender diversity (X) and ESG disclosure (M). The results presented in Table 8, corresponding to Model 2, support the argument outlined in H2. Specifically, at a significance level of 1%, a positive association between BGD and ESG is evident, supported by a p-value of 0.001 and a coefficient (β_1) of 0.222. This implies that the presence of female directors on Saudi corporate boards is linked to the advancement of companies' ESG performance and communication. This finding aligns with a considerable body of research that emphasizes the pivotal role of board gender diversity in enhancing companies' sustainable performance, as demonstrated in studies such as Yasser et al. (2017), Cabeza-García et al. (2018), Fernández-Gago et al. (2018), Harjoto and Laksmana (2018), Pucheta-Martínez et al. (2018), Aladwey et al. (2022), Khatri (2023), and numerous others. Additionally, Ebaid (2022), based on a sample of

67 Saudi-listed companies for 2014–2019, reveals that the ratio of female directors on the board positively correlates with the extent of CSR disclosure. However, this correlation is statistically nonsignificant. Similarly, Chebbi and Ammer (2022), drawing from a sample of 38 Saudi companies from 2015 to 2021, reported a positive but nonsignificant association between BGD and ESG. Chebbi and Ammer (2022) contend that a plausible explanation for the nonsignificant association is the constrained presence of female directors on the corporate boards within the sample they utilized.

Table 8 also provides insights into the relationship between ESG and control variables. Based on a significance threshold of 1%, the results reveal a positive and significant relationship between BS and ESG, as indicated by a *p*-value of 0.005 and a coefficient (β_3) of 0.695. This finding suggests that more directors on Saudi boards are associated with a higher propensity to engage in sustainability activities and initiatives. This is consistent with the perspective presented by Aladwey et al. (2022) from an agency theory standpoint, which suggests that larger corporate boards enhance their capacity to oversee management, improve transparency, and disclose non-financial information while reducing information asymmetry. In addition, Table 8 also reveals a positive effect of AGE on ESG at a significance level of 1%, with a *p*-value = 0.005 and a coefficient (β_5) of 0.968. Hence, it can be observed that older Saudi companies are more receptive to sustainable practices and demonstrate greater willingness to pursue sustainable objectives compared to younger companies. This aligns with a similar observation by Fitranita et al. (2023).

4.3.3. Estimating the Mediating Effect of ESG Disclosure on the Relationship between Board Gender Diversity and Firm Value

Steps three and four involved estimating the indirect relationship between board gender diversity (X) and firm value (Y), specifically focusing on the mediating effect of ESG disclosure (M). Upon incorporating ESG into Model 3, the association between BGD and FV becomes non-significant, as reported in Table 8, Model 3, contrasting with the significant relationship presented in Table 8, Model 1. In addition, at a 1% significance level, Table 8, Model 3 highlights a significant and positive association between ESG and FV, supported by a *p*-value of 0.002 and a β_2's coefficient of 0.016. These results all together indicate that ESG fully mediates the relationship between BGD and FV, confirming the fulfillment of H3. Moreover, we illustrate the mediation effect using the Sobel z-test. The outcomes presented in Table 8 indicate that ESG serves as a significant mediator in the relationship between BGD and FV, where the *p*-values of Sobel of 0.002, Aroian of 0.025, and Goodman of 0.019 are all significant, falling below the 5% significance threshold. Accordingly, ESG functions to offset the effect of BGD on FV. In addition, the entire mediation entails that the collaboration of ESG and BGD contributes to the enhancement of FV.

As per the Sustainable Development Report (2023), the Sustainable Development Goals (SDGs) advocate for governments to promote gender equality and establish it as a critical agenda within the framework of sustainable development goals. Accordingly, ESG plays a prominent role in enhancing Saudi companies' values in the KSA context. Accordingly, this finding aligns with the core principles of Vision 2030. As previously mentioned, Vision 2030 strongly emphasizes sustainable growth, and its guiding principles closely resonate with ESG practices. Moreover, ESG acts as a complete mediator, effectively channeling the intended impact of BGD in enhancing the value of Saudi companies. Simply put, the sustainable concept takes precedence, outweighing the influence of BGD in enhancing a company's value because gender diversity is fully integrated within the sustainability framework.

Similarly, Filho et al. (2022) argue that gender-related matters, particularly gender equality, can be viewed as overarching concerns within the realm of sustainability, contributing to the achievement of sustainable development goals, even though the precise mechanisms for their inclusion may not always be evident. Similarly, Alarcón and Cole (2019) assert that the pathways to achieving sustainability goals also serve as a means to promote gender equality and diversity. It is worth noting that the vice versa would not

happen. As evidence, Ahern and Dittmar (2012) and Matsa and Miller (2013) contend that the significant gender imbalance on boards may not necessarily lead to swift changes in organizational ESG activities.

5. Robustness Check

Similar to Salhi et al. (2020) and Alodat et al. (2023), in order to assess the robustness of our main findings, we re-conducted the main analysis to determine whether the mediating role of ESG holds if we substitute the measure of our dependent variable: firm value. Accordingly, we re-estimated the main analysis using FV-SP as an indicator of firm value. Following D'Amato and Falivena (2020), FV-SP was measured as the annual growth rate of the stock price for $firm_i$ in $year_t$, and calculated as follows:

$$\text{FV-SP}_{it} = [(P_{it} - P_{it-1})/P_{it-1}] \times 100$$

where:

P_{it} represents the stock price of $firm_i$ in $year_t$.

P_{it-1} represents the stock price of $firm_i$ in the previous $year_{t-1}$.

Data for the stock price were manually collected from the Saudi stock exchange (Tadawul). The outcomes displayed in Table 9 show a similarity to the findings reported earlier in Table 8.

Table 9. Additional test: the alternate measure of firm value.

	Model 1 (FV-SP)		**Model 2 (ESG)**		**Model 3 (FV-SP)**	
	Coef.	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
Firm value (FV)	6.907 **	0.037	1.359 ***	0.001	1.802	0.852
ESG					0.449 **	0.046
Board independence (BI)	−2.962 **	0.043	−7.761	0.469		
Board size (BS)	1.602	0.411	1.668 **	0.005		
Firm size (FS)	0.211	0.871	1.083	0.160		
Firm age (AGE)	2.061	0.969	1.600 **	0.005		
Leverage (LEV)	0.467 **	0.036	−0.037	0.701		
Constant	−1.03	0.499	−6.07 ***	0.003	−3.051	0.970
R-squared	0.126		0.373		0.160	
Hausman test	2.24 ***		1.80 *		2.61 ***	
Firm and year effect	Yes		Yes		Yes	
N-Obs	108		108		108	
Sobel						0.058
Aroian						0.059
Goodman						0.074

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. Conclusions

Our paper aims to explore the mediating effect of ESG disclosure on the relationship between gender diversity and firm value, taking into account the cultural context. Based on a sample of Saudi-listed financial companies from 2021 to 2022, the results show a negative and significant association between gender diversity and firm value. Upon introducing

the ESG score as a mediator variable, the results indicate that ESG fully mediates the relationship between gender diversity and firm value in Saudi financial companies.

Our findings uncover a significant revelation: there exists a negative relationship between corporate gender diversity and firm value, particularly within the context of Saudi Arabia. This observation diverges from the prevailing literature, which predominantly advocates for a positive association. A possible justification is that diverse cultural contexts imply distinct proportions of women required on corporate boards to realize firms' values. It appears that the results may be aligned with the cultural dynamics of Saudi Arabia, where traditional notions of masculinity play a substantial role. Notably, the low representation of female directors on corporate boards within the Saudi financial sector underscores the intricate interplay between gender diversity and cultural dimensions. When involving the ESG score as a mediating variable, our results indicate that ESG fully mediates the relationship between gender diversity and firm value in Saudi financial companies. The sustainable notion dismisses the effect of BGD on promoting a firm's value because gender diversity is fully embedded within sustainability's purview. This suggests that cultural dimensions, such as masculinity, may intersect with ESG considerations to shape the financial landscape in this unique context. Our results are robust for alternate measures of firm value.

The findings of our paper have several implications for investors, policymakers, and regulators. First, our findings offer valuable insights for investors seeking to assess the influence of board gender diversity on a company's overall value. Second, the findings highlight the significance of gender diversity in the realm of sustainability, indicating that enhancing female representation on corporate boards is a crucial strategy for firms aiming to improve their ESG scores. Furthermore, this encouragement motivates firms to actively participate in sustainability initiatives actively, recognizing their positive impact on overall firm value. Consequently, it serves as a compelling prompt for policymakers to recognize the importance of fostering sustainability disclosures among Saudi companies, even though such disclosures remain voluntary. Additionally, these findings advocate for regulators and policymakers to establish rules that facilitate increased female participation on corporate boards, particularly in light of the absence of mandatory minimum requirements for female representation.

Gender diversity has become a fundamental component of Saudi Arabia's Vision 2030, and it is anticipated that fostering gender diversity will play a pivotal role in achieving the objectives of this vision. The persistence of the cultural dimension of a predominantly masculine society in Saudi Arabia may present obstacles to realizing the potential benefits of gender diversity on corporate performance. Within the sustainability framework, there may be a mediating effect of gender diversity on firm value. Specifically, sustainable performance entails the promotion of higher female representation on boards. This notion of sustainability could enhance the value of Saudi firms and contribute to the transformation of the cultural landscape in Saudi Arabia, shifting it from one dominated by traditional masculinity to a more inclusive and diverse notion of corporate governance and equality. Thus, the progression of Saudi companies toward achieving the goals of Vision 2030 encompasses a dedication to sustainable practices, wherein gender diversity on Saudi boards plays a crucial role. This commitment is essential to realizing the positive impacts of gender diversity on the value of Saudi firms.

The limitations of our paper could open new avenues for future research. The study explores how a cultural dimension, namely masculinity–femininity, influences the mediating effect of the ESG score on the relationship between gender diversity and firm value. Further research into the intricate dynamics of cultural influences on corporate performance, such as "individualism-collectivism," "uncertainty avoidance," and "power distance," is warranted to gain a deeper understanding of these complex relationships within Saudi Arabia. In addition, our study examines the mediating effect of ESG score over two years, 2021 and 2022. Other researchers could conduct a longitudinal panel study on the effect of gender diversity on the firm value for the period from 2016, the year of the

inception of Saudi Vision, to 2030, the year at which the vision is accomplished. In addition, it is anticipated that the participation of female directors on Saudi boards will increase after 2030. Consequently, it would be intriguing for other researchers to explore the impact of achieving a critical mass of female directors on the corporate performance of Saudi companies. Furthermore, subject to data availability, our sample only covers the financial sector in Saudi Arabia. It could be interesting if other researchers expand the sample size to include Saudi-listed non-financial companies to address any difference in findings.

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Notes

1 https://www.arabnews.com/node/2267256/business-economy (accessed on 12 March 2023).

2 https://www.vision2030.gov.sa/en/vision-2030/vrp/fiscal-sustainability-program/ (accessed on 2 November 2023).

3 Saudi Exchange or Tadāwul is a stock exchange in Saudi Arabia that was formed in 2007 as a joint stock company and the sole entity authorized to act as a securities exchange in Saudi Arabia.

4 https://sseinitiative.org/wp-content/uploads/2021/11/Tadawul-ESG-Disclosure-Guidelines-EN.pdf (accessed on 2 November 2023).

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The Relationship between Promoters' Holdings, Institutional Holdings, Dividend Payout Ratio and Firm Value: The Firm Age and Size as Moderators

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Abstract: The present paper aims to empirically examine the effect of promoters' holdings and institutional holdings on dividend payout ratio and the firm value. Most importantly, this paper explores the age and size of the firm as the moderators in the relationships. Data collected from 23 companies from India and 253 data points were analyzed to test the hypothesized relationships. The results indicate that promoters' holdings and institutional holdings are positively associated with dividend payout ratio and firm value. Further, moderator hypotheses suggest that (i) firm age moderates the relationship between promoters' holdings and dividend payout ratio, (ii) firm size moderates the relationship between institutional holdings and dividend payout ratio, (iii) firm age moderates the relationship between promoters' holdings and firm value, and (iv) firm size moderates the relationship between institutional holdings and firm value. The implications for theory and practice are discussed. The conceptual model developed and tested in this research contributes to both the literature on dividend payout ratio and firm value and to the needs of institutional investors interested in increasing the firm value.

Keywords: institutional holdings; promoters' holdings; firm value; dividend payout ratio; firm size

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1. Introduction

The institutional and promoters' holdings, firm value, and dividend payout ratios have been widely researched by scholars in financial management (Grinstein and Michaely 2005; Jory et al. 2017; Rozeff 1982; Strickland 1996;). Extant research reported that mitigating the agency costs helps enhance firm value primarily through governance mechanism (Bathala et al. 1994; Odum et al. 2019; Shleifer and Vishny 1986). The significance of institutional holdings in enhancing the firm value has been highlighted by some researchers in the past (e.g., Chen et al. 2018; Chung et al. 2003; Coffee 1991; Steiner 1996; Tsai and Gu 2007). However, the boundary conditions as to how these holdings affect the firm value have received little attention from the researchers. On the contrary, dividend payout ratio has received increasing attention by researchers, primarily because of its potential effect on the firm value (Budagaga 2017; Damayanti and Palinggi 2023; Nurokhmah et al. 2023; Setiyawati et al. 2017; Tjipta et al. 2022; Yang and Ma 2022). It is well documented that institutional holdings and dividend payout ratio play a significant role in increasing the

firm value. However, relatively scant research addressed the moderating role of size and age of the firm.

From a theoretical standpoint, the large shareholders have the inherent power to influence the governance mechanism by applying pressure on the board to revamp and dance to the tunes of these investors(Shleifer and Vishny 1997). However, the stakes involved are very high for these institutional investors. Hence, they carefully monitor even their drastic moves once they realize that it would decrease the value of the firm. Therefore, institutional and promoters' holdings act as a double-edged sword, and they determine which side they use to the public, but the consequences can only be known from their actions. It depends on the institutional investors to examine the effect of their actions. Some researchers contend that there is positive association of the institutional holdings to the firm value (Drakos and Bekiris 2010; Hamidullah and Shah 2011; Pant and Pattanayak 2008).

The research on the relationship between dividend payout ratio and firm value is exhaustive (Lumapow and Tumiwa 2017; Odum et al. 2019). For example, in a study on chemical companies in India roughly two decades ago from 1996–1997 to 2005–2006, it was found that dividend policy has a significant effect on the shareholder's wealth (Azhagaiah and Priya 2008). Various other researchers also corroborated the positive impact of dividend policy on the firm value (De Wet and Mpinda 2013).

While the direct linear effects of age and size of firm are understandable, it would be interesting to investigate how age and size changes the strength of relationship between institutional and promoters' holdings on dividend payout ratio and firm value. From a theoretical standpoint, firm size and age will have significant direct influence on firm value and dividend payout ratio. It is logical that as the firm expands in size it is more likely to have higher earnings, and the firms will have a choice to pay higher dividends. At the same time, when a firm is in the industry for a long time (representing the age), it is more likely that it will have a considerable size of the market and have higher rate of returns, a part of which may be distributed as dividends. In this study, our primary interest is to see the moderating effect of age and size on dividend payout ratio and firm value. Since prior researchers have not explored this relationship, this study aims to bridge the gap by answering the following research questions (RQs):

RQ1: How do promoters' holdings effect dividend payout ratio and firm value?
RQ2: How do institutional holdings effect dividend payout ratio and firm value?
RQ3: How does firm age moderate the relationship between promoters' holdings and (i) dividend payout ratio and (ii) firm value?
RQ4: How does firm size moderate the relationship between institutional holdings and (i) dividend payout ratio and (ii) firm value?

This study makes five significant contributions to the literature on dividend payout ratio and firm value. First, the study aligns with the studies in the literature that show that promoters' holdings are significantly and positively related to dividend payout ratio and firm value. Second, consistent with past studies, this study provides empirical evidence that institutional holdings have a positive and significant effect on dividend payout ratio and firm value. Third, this study found that the relationship between promoters' holdings and dividend payout ratio is stronger (positive) for older companies in terms of age, whereas the relationship is weaker (negative) for new firms (firms of a lower age). Fourth, the results reveal that promoters' holdings have higher firm value for new firms when compared to old firms. However, firm value increases exponentially with the increase in age of a firm. Fifth, for big firms, institutional holdings result in a higher dividend payout ratio and higher value of the firm as compared to small firms. To sum up, the oversimplified moderated model developed and tested in this research makes a significant contribution to the literature.

2. Hypothesis Development

2.1. Promoters' Holdings and Dividend Payout Ratio

A promoter is a person or a group of persons, who are involved in the incorporation of a corporation. Promoters are the significant part in the organization and management of a business. According to the Securities and Exchange Board of India (SEBI's) Disclosure and Investor Protection Guidelines, 2000 (DIP Guidelines) and Substantial Acquisition of Shares and Takeover Regulations, the 1997 (Takeover Code) "Promoter or Promoter Group" exercise ample control over the company by virtue of their shareholding and management rights (Kumar and Singh 2013). Promoters' holdings are the percentage of shares held by the promoters group out of the total outstanding shares. Companies with higher promoters' holdings pay a high dividend to their shareholders by exercising effective control over the management and reducing the cost of agency (Arora and Srivastava 2021; Jawade 2021). Promoters' holdings have a positive effect on the dividend payout of BSE 500 listed companies in India (Gupta 2017). On the contrary, companies with more than 65 to 70 per cent promoters' holdings result in having a 21.3 per cent decrease in the dividend payout ratio, due to higher tax on dividend income (Dhamija and Arora 2019). Earlier scholars reported that larger amounts of promoter holding demotivate the promoters to choose a higher payout ratio (Kumar 2006). From the above discussion we hypothesize the relationship as follows:

Hypothesis 1 (H1): *Promoters' holdings are positively associated with dividend payout ratio.*

2.2. Promoters' Holdings and Firm Value

The traditional scholars in financial management have empirically advocated that promoters' holdings result in a decrease in agency cost and increase the firm value because of the vested interests the promoters have in the wealth of the company (Jensen and Meckling 1976), since the personal stakes involved are substantial promoters' attempt to maximize the firm value (Shleifer and Vishny 1988). Wang (2018) also found a non-linear relationship between promoter' holdings and firm value where the firm value first declines with an increase in promoter' holdings and then upsurges as promoters own more shares. On the contrary, an increase in promoters' holdings has a negative effect on firm value, due to the entrenchment effect (Demsetz 1983). To resolve the contradictory findings, Claessens et al. (2002) suggest that there is a threshold level of stock holdings beyond which the costs of minority shareholders outweigh the benefits, resulting in a decrease in the firm value. Concentrated promoter ownership represents holding at least five per cent of a firm's shares (Pandey and Sahu 2019; Selarka 2005). Interestingly, Yasser and Mamun (2015) found an insignificant association between the ownership concentration and firm value. Though some studies found a negative association of promoters' holdings with firm value, extant research skewed towards positive association (Abbasi et al. 2017; AL-Najjar 2016; Denis and McConnell 2003; Gaur et al. 2015; Yasser and Mamun 2017). Based on the above arguments, the following hypothesis is offered:

Hypothesis 2 (H2): *Promoters' holdings are positively associated with the firm value.*

2.3. Institutional Holdings and Dividend Payout Ratio

According to Koh (2003), institutional ownership is defined as the number of shares out of the total shares possessed by institutions at the end of the year. Institutional holdings represent the ownership by institutions such as mutual fund companies, pension fund companies, private foundations, investment companies, and other large agents who manage funds on behalf of others (Ratnawati et al. 2019). Jacob and Jijo Lukose (2018) highlighted the fact that institutional ownership plays a vital role in dividend payout ratio. Since institutional investors periodically monitor the actions of chief executive officers who make policies about the declaration of a dividend, it is more likely that the greater the institutional holdings in the firm, the greater will be the dividend payout ratio (Jensen

1986). Institutional investors who have more than five per cent in shares will have more control over the way in which the earnings are distributed as dividends (Putri et al. 2017). Institutional investors prevent the opportunistic behavior of the managers, which may influence the dividend decisions made by the top management (Annisa and Nazar 2015; Ayunitha et al. 2020). Khan (2006) found a positive relationship between dividends and shareholding for insurance companies in the United Kingdom. Since the institutional investors hold a significant portion of shareholdings in a firm, they exercise their voting rights in favor of dividends (Chang et al. 2016; Firth et al. 2016; Grinstein and Michaely 2005). Thus, several researchers have found a positive association for institutional ownership and dividend payout ratio (Affandi et al. 2019; Kania and Bacon 2005; Lahiri 2013; Mirza 2014; Thanatawee 2013). The literature review also reveals a negative effect of institutional ownership on the dividend payout ratio (Arora and Srivastava 2021; Basri 2019; Gusni 2017; Thanatawee 2014a; Taufan and Wahyudi 2013). The findings are therefore inconclusive. However, in the middle of the mixed findings, we support the positive association of institutional holdings on dividend payout ratio, and offer the following hypothesis:

Hypothesis 3 (H3): *Institutional holdings are positively associated with dividend payout ratio.*

2.4. Institutional Holdings and Firm Value

The performance of a firm is often assessed by its market value (Hasibuan and Khomsiyah 2019); the responsibility of the CEOs and the top management team is to maximize the wealth of shareholders, which depends on the firm value (Nwaobia et al. 2016). In the Indian context, a plethora of researchers have documented the positive effect on institutional holdings and firm value of reducing agency costs (Ahmad and Jusoh 2014; Bhattacharya and Graham 2009; Ferreira and Matos 2008; Karpavicius and Yu 2017; Lin and Fu 2017; McConnell and Servaes 1990; Muniandy et al. 2016; Ongore 2011; Thanatawee 2014b). On the contrary, Bebchuk et al. (2017) opined that institutional investors had less incentive to monitor the activities of the CEOs and the top management, which may have a negative effect on the firm value. Navissi and Naiker (2006) found that institutional ownerships of up to 30 per cent had a positive impact on firm value, but ownerships above 30 per cent reduced firm value. Furthermore, some researchers argue that there is a negative relationship between institutional holdings and firm value (Chen et al. 2008; Jennings 2005; Mollah et al. 2012). From the above argument, we offer the following hypothesis.

Hypothesis 4 (H4): *Institutional holdings are positively associated with the firm value.*

2.5. Moderating Effect of Firm Age

Firm age is one of the important factors considered by prospective investors when choosing an investment alternative of a firm. Firm age reflects the capability of the organization to run a business (Putri and Rachmawati 2017). Firm age is the number of years since the company has been incorporated. The age of the company is calculated as the year of study minus the date of incorporation (Saxena and Sahoo 2020). The study of the moderation of age between promoters' holdings and the dividend payout ratio and firm value is new in the literature. The researcher would like to make an attempt to study this in the Indian context. So, the following hypothesis is developed:

Hypothesis 1a (H1a): *Firm age moderates the relationship between promoters' holdings and dividend payout ratio.*

Hypothesis 2a (H2a): *Firm age moderates the relationship between promoters' holdings and firm value.*

2.6. Moderating Effect of Firm Size

Firm size plays an important role in empirical corporate finance (Dang et al. 2018; Hashmi et al. 2020). Firm size affects in a practical way many important corporate finance decisions, such as: (i) investment decision (Bakke and Whited 2010; George et al. 2011), (ii) financing decision (Gonzalez and Gonzalez 2012; Kurshev and Strebulaev 2015), (iii) dividend decision (Adjaoud and Ben-Amar 2010; Moortgat et al. 2017), and (iv) working capital decision (He et al. 2017; Jalal and Khaksari 2020). Firm size always has a significant effect on firm value (Nurainy et al. 2013). Bhushan (1989) found a significant and positive relationship between firm size and the number of analysts following the firm. A higher analyst following may reduce information asymmetry, as well as providing a stronger monitoring from the capital market. Thus, firm size has a positive moderating effect on the relationship between ownership structure (institutional holding) and firm value (Chakkravarthy et al. 2023; Suriawinata and Nurmalita 2022). From the above premise, the following two hypotheses were developed:

Hypothesis H3a: *Firm size moderates the relationship between institutional holdings and dividend payout ratio.*

Hypothesis H4a: *Firm size moderates the relationship between institutional holdings and firm value.*

The conceptual model is presented in Figure 1.

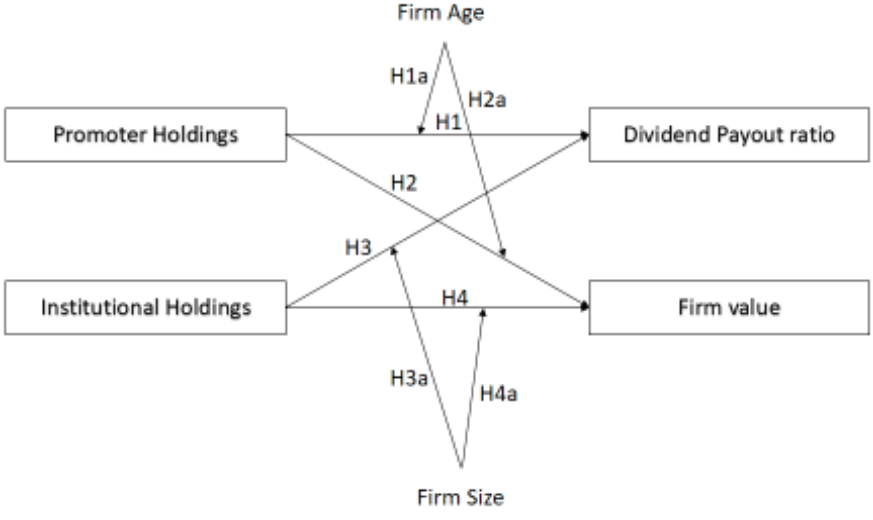

Figure 1. Conceptual Model.

3. Method

The present study aims to examine the effect of promoters' holdings and institutional holding and its effect on dividend payout ratio and firm value, and it also provides empirical evidence for the moderating role of firm age and firm size. The financial data were collected from secondary sources. The researcher used Prowess IQ powered by the Centre for Monitoring Indian Economy (CMIE) to collect the financial information, which is the most widely used database for collecting financial information in India. The samples were 23 companies listed on the Bombay Stock Exchange (BSE) Healthcare Index during November 2021. To increase the validity of the sample unit, the researcher collected data for the companies paying dividends consecutively for a period of 11 years, from March 2011 to March 2021.

The rationale for selecting 23 companies stems from the post-COVID-19 situation of publicly traded companies. Though the outbreak of the COVID-19 pandemic devastated the corporate sector in all the industries, the healthcare industry has outperformed the others in the market. Therefore, our focus was on the healthcare sector. During November 2021 there were 90 companies listed in the BSE Healthcare Index, out of which we considered data from 23 (which represents 25% of the companies) publicly traded companies in the healthcare industry, because we were interested in companies that have been distributing dividends continuously for 11 years. We did not include the companies that failed to pay dividends in one or more years during the study period.

4. Measurement of Variables

The quality of the research work is based on the quality and appropriateness of the variables chosen and its measurement. Here, in Table 1, the researcher provides the variables used and their measurement.

Table 1. Variables and the Measurements.

Variables	Type of Variable	Measurement
Firm value (Tobin's Q)	Dependent	(Market value of equity + Book value of equity)/Book value of assets
Dividend payout ratio	Dependent	Dividend per share/Earning per share
Promoters' Holdings	Independent	Percentage of shares held by Promoters /Total outstanding shares
Institutional Holdings	Independent	Percentage of shares held by institutions/Total outstanding shares
Firm age	Moderator	Number of years of life since inception
Firm size	Moderator	Natural log of total assets

5. Analysis

5.1. Descriptive Statistics and Multicollinearity

The descriptive statistics (means, standard deviations, and zero-order correlations) are presented in Table 2.

Table 2. Descriptive statistics (means, standard and zero-order correlations).

	Mean	S.D	1	2	3	4	5	6
1. Promoters' Holdings	1.75	0.10	1					
2. Institutional Holdings	1.15	0.43	0.48 **	1				
3. Firm Age	1.65	0.16	0.49 **	−0.17 **	1			
4. Firm Size	10.36	0.63	−0.37 **	0.74 **	−0.022 **	1		
5. Firm Value	0.57	0.19	0.04	0.37 **	−0.02	0.34 **	1	
6. Dividend payout ratio	2.55	0.18	0.06	0.05	0.10	0.05	0.10	1

** $p < 0.01$.

The preliminary analysis of the correlation reveals that the highest correlation was 0.74 (between institutional holdings and firm size). If correlations between the variables exceed 0.75, a multicollinearity problem is said to be present. In this study, the correlations between all the variables were within the threshold of 0.75, and hence multicollinearity is not a problem (Tsui et al. 1997). We also checked for variance inflation factor (VIF) values and found these to be less than 5, suggesting that the data are not infected by multicollinearity (Hair et al. 1998).

5.2. Statistical Analysis

We followed the ordinary least squares (OLS) in testing the hypotheses. Since moderators are involved in the model, we used hierarchical regression, a part of OLS. In this study, firm age and size are the moderators expected to directly relate to the dependent variables: dividend payout ratio and firm value. However, direct relationships may not imply that the moderator relationships hold good. In this research, we hypothesized that firm size and age are moderators that will interact with the independent variables to significantly influence the dependent variables: firm value and dividend payout ratio. Following Aiken and West (1991) and Richardson et al. (2015), we used hierarchical regression to test the hypotheses. The empirical model presented in this study can be tested with different populations, and it is very likely that the results will not be significantly different from what we obtained in this study.

5.3. Results of Dividend Payout Model

Before running the regression and testing hypotheses, we checked for the normality of the data and heteroskedasticity. Since these are not survey-based data, the reliability cannot be checked using Cronbach's alpha. The variables and the measurement of variables were captured in Table 1.

In general, age and size are labeled as 'control variables'. But, in this research we consider the age and size as moderator variables, and hence we entered the age and size as moderators in the second step of the regression equation.

The hierarchical regression result of the effect of main variables on dividend payout ratio is represented in Table 3. The regression coefficient of promoters' holdings ($\beta = 0.109$, $p < 0.05$), institutional holdings ($\beta = 0.146$, $p < 0.05$), and firm age ($\beta = 0.103$, $p < 0.05$) were positive and significant, thus supporting H1 and H3. And the regression coefficient of firm size ($\beta = 0.014$) was not significant in determining the dividend payout ratio of companies listed in the BSE S&P Healthcare index. The regression model was significant, and explained 13.7 per cent variance in dividend payout ratio because of the independent variables [$R^2 = 0.137$; Adj $R^2 = 0.134$; F (4, 248) = 75.67; $p < 0.05$].

The model was significant, and explained 19.5 per cent variance in the dividend payout ratio because of these interactions (as well as the main variables) [F (6, 246) = 59.7, $p < 0.001$; $R^2 = 0.195$, and adjusted $R^2 = 0.191$, $\Delta F = 33.04$, $p < 0.001$; $\Delta R^2 = 0.058$]. These results support the moderation hypotheses H1a and H3a.

Table 3. Hierarchical regression results of promoters' holdings, institutional holdings on dividend payout ratio and firm value, with firm age and firm size as moderators.

Variables	**Column 1**	**Column 2**	**Column 3**	**Column 4**
Dependent Variable---→	**Dividend Payout Ratio**	**Dividend Payout Ratio**	**Firm Value**	**Firm Value**
	Step 1	Step 2	Step 1	Step 2
Main variables				
Promoter's Holdings	0.109 *	0.132 *	0.617 ***	0.191 *
Institutional Holdings	0.146 *	0.152 *	0.188 *	0.366 ***
Firm Age	0.103 *	0.110 *	0.101 *	0.238 *
Firm Size	0.014	0.104 *	0.034	0.063
Moderators				
Promoters' Holdings × Firm Age		0.255 *		0.793 ***
Institutional Holdings × Firm Size		0.182 *		0.161 *

Table 3. *Cont.*

Variables	Column 1	Column 2	Column 3	Column 4
Dependent Variable---→	**Dividend Payout Ratio**	**Dividend Payout Ratio**	**Firm Value**	**Firm Value**
R^2	0.137	0.195	0.209	0.228
Adj R^2	0.134	0.191	0.204	0.213
ΔR^2		0.058		0.015
F	75.67 *	59.07 ***	16.41 ***	12.13 ***
ΔF		33.04 ***		3.09 ***
df	4, 248	6, 246	4, 248	6246

Standardized beta coefficients are reported. *** $p < 0.001$; * $p < 0.05$. Standard errors and t values are in parentheses.o examine the effect of moderator variables, in the second step the interaction terms were entered into the regression equation. The firm age and size are used as a moderator in the equation. The regression results from column 2 (step 2) reveal the interaction of promoters' holdings × firm age ($\beta = 0.255$; $p < 0.05$), and institutional holdings × firm size ($\beta = 0.182$; $p < 0.05$); hence, the hypotheses H1a and H3a are supported.

5.4. Results of Firm Value Model

The effect of the main variables on firm value is represented in Table 3 (Column 3). The results of the regression coefficient of promoters' holdings ($\beta = 0.617$, $p < 0.001$), institutional holdings ($\beta = 0.188$, $p < 0.05$), and firm age ($\beta = 0.101$, $p < 0.05$) are positive and significant, thus supporting H2 and H4. And the regression coefficient of firm size ($\beta = 0.034$) was not significant in determining the firm value of selected companies listed in the BSE S&P Healthcare index. The regression model was significant, and explained 20.9 per cent variance in firm value because of the independent variables [$R^2 = 0.209$; Adj $R^2 = 0.204$; F (4, 248) = 16.41; $p < 0.001$].

To examine the effect of moderator variables, in the second step the interaction terms were entered into the regression equation. The firm age and size are used as a moderator in the equation. The regression results from column 4 (step 2) reveal the interaction of promoters' holdings × firm age ($\beta = 0.793$; $p < 0.001$) and institutional holdings × firm size ($\beta = 0.161$; $p < 0.05$); hence, the hypotheses H2a and H4a are supported.

The model was significant, and explained 22.8 per cent variance in the firm value because of these interactions (as well as the main variables) [F (6, 246) = 12.13, $p < 0.01$; $R^2 = 0.228$, and adjusted $R^2 = 0.213$, $\Delta F = 3.09$, $p < 0.001$; $\Delta R^2 = 0.015$]. These results support the moderation hypotheses (H2a, H4a).

While the direct effects of promoters' holdings and institutional holdings on dividend payout and firm value are self-explanatory, it would be necessary to present the expected interaction effects of firm age and firm size on the dependent variables' dividend payout ratio and the firm value. The expected results of moderation are shown in the following figures.

The interaction plots of promoters' holdings and firm age are represented in Figures 2 and 3. As shown in Figure 2, companies with a firm age of more than 5 per cent tend to increase the effect of promoters' holdings on dividend payout ratio positively. Where the trend line shows an upward trend, when the promoters' holding rises the dividend payout ratio also rises. With regard to Figure 3, companies with a firm age of less than 5 per cent tend to increase the effect of promoters' holdings on firm value, whereas firms with ages of more than 5 per cent tend to increase the firm value but not above those of the firms with less than 5 per cent. Thus, this supports the moderation hypotheses H1a and H2a.

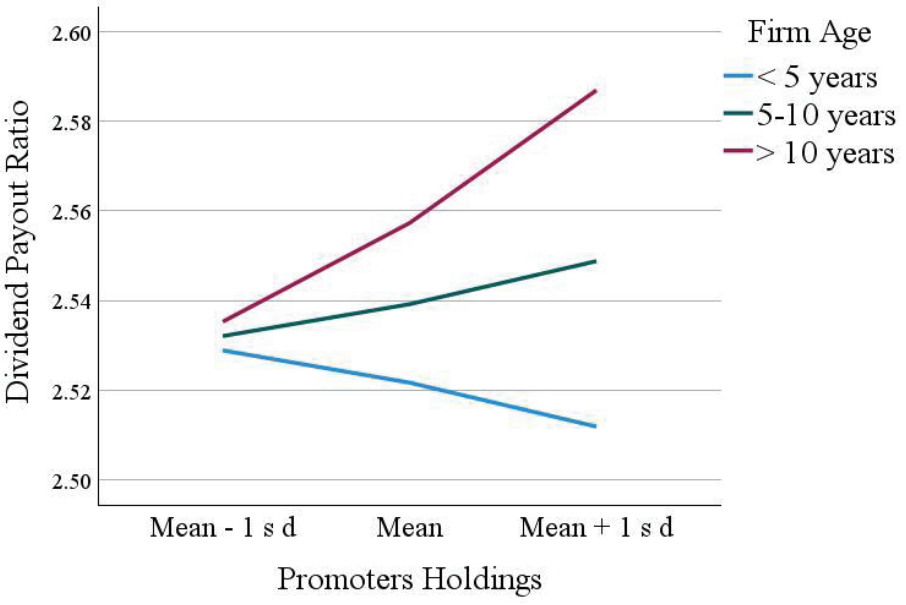

Figure 2. Firm age as a moderator in the relationship between promoters' holdings and dividend payout ratio.

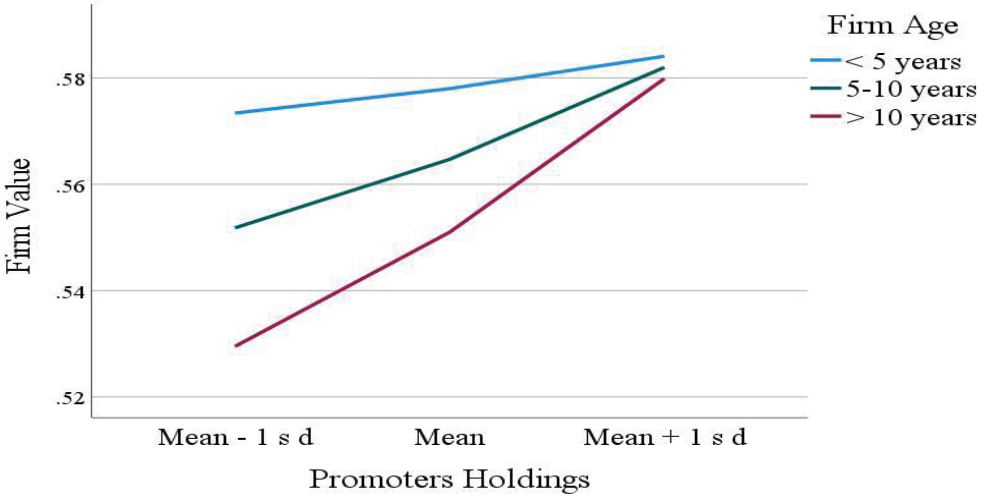

Figure 3. Firm age as a moderator in the relationship between promoters' holdings and firm value.

The interaction plots of institutional holdings and firm size are represented in Figures 4 and 5. As shown in Figure 4, the interaction between institutional holdings and firm size is positive. The rise in the firm's size increases the effect of institutional holdings on the dividend payout ratio. Regarding Figure 5, the interaction between institutional holdings and firm size is positive. The rise in the firm's size increases the effect of institutional holdings on the firm value. Thus, it supports the moderation hypotheses H3a and H4a.

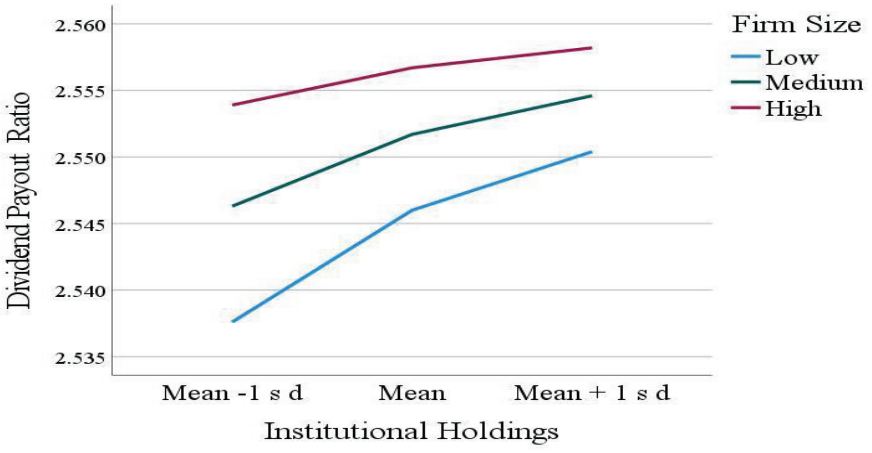

Figure 4. Firm size as a moderator between institutional holdings and dividend payout ratio.

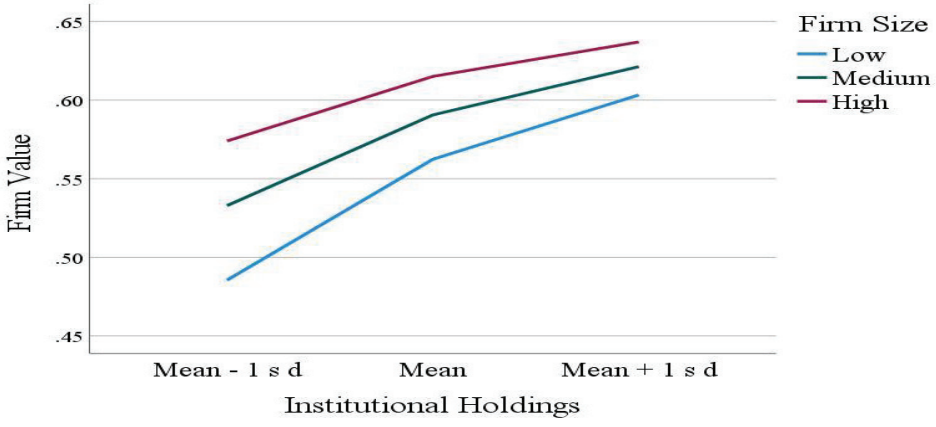

Figure 5. Firm size as a moderator in the relationship between institutional holdings and firm value.

5.5. Direct Effects of Firm Age and Firm Size

This study focuses mainly on the moderating effect of firm age and firm size in the relationship between promotors' holdings and firm value and institutional holdings and dividend payout ratio. Since the moderator variables also have a direct influence (Aiken and West 1991), the direct hypothesis of the effect of moderator variables on the dependent variables is omitted by the researchers. As shown in Table 3, the immediate effects of firm age and size on dividend payout ratio and firm value are positive and significant. Since these direct (linear) effects are understandable, we did not hypothesize these in this research.

6. Discussion

This paper attempts to underscore the importance of firm age and size in changing the strength of the relationship between promoters' holdings, institutional holdings, dividend payout ratio, and firm value.

First, it is proposed that promoters' holdings would positively impact the dividend payout ratio. The underlying logic, supported by the extant research, is that promoters would like to create an impression in the minds of potential investors about the positive intent of the company to take care of the shareholders through good periodical dividend

payout. As the investors differ in their requirements, some prefer regular dividends. In contrast, some young investors may care about something other than periodical dividends, and are more interested in the firm's value. Therefore, the promoters with significant holdings would see regular dividends paid to the stockholders.

Moreover, the higher the promoters' holdings, the more control over the business affairs, whereby the promoters streamline the company's activities and reduce the agency cost, thus increasing the dividend payout to the shareholders. The promoters can also enjoy this as an incentive for the monitoring role. Thus, the study's findings corroborated previous findings (Arora and Srivastava 2021; Gupta 2017). Second, the promoter's holdings also enhance the firm's value, as their efforts are directed towards its success, measured in terms of firm value. So, it is self-explanatory that the influential monitoring role of promoters' holdings promotes efficiency in the utilization of resources, thus paving the way to increasing the firm's value. Thus, the findings support the existing literature (Abbasi et al. 2017; Gaur et al. 2015; AL-Najjar 2016; Yasser and Mamun 2017). Third, the institutional holdings also operate similarly to promoters' holdings, affecting the positive relationship between dividend payout and firm value. Thus, the study's findings support the previous literature (Lin and Fu 2017; Muniandy et al. 2016; Thanatawee 2014b).

Regarding the moderation hypothesis, firm age moderates the relationship between promoters' holdings on dividend payout ratio and firm value. Moreover, firm size moderates the relationship between institutional holdings' dividend payout ratio and firm value. Thus, the findings support the positive moderation hypothesis of previous studies (Chakkravarthy et al. 2023; Suriawinata and Nurmalita 2022).

6.1. Practical Implications

The findings from this study have several implications for the companies interested in understanding the antecedents of firm value and dividend payout ratio. As many companies in the pharmaceutical industry have been in the industry for quite a long time, growing competition between the companies prompts the top management team to maintain a sustained competitive advantage by retaining the existing shareholders. One way of doing it is to increase the dividend payout, lest the shareholders move out of the companies and invest in alternative companies that pay higher dividends. The results from this study explain how the firm value is impacted by age and size. When companies shy away from increasing their size, the present study signals that it is a good idea to explore diversification of investments and expand by engaging in either a concentric or conglomerate strategy, depending on the available opportunities. This study also provides valuable insights into companies in general, apart from the pharmaceutical companies, about the boundary conditions for dividend payout ratio and firm value.

6.2. Limitations and Future Research

Every research is confined to sample units chosen for the study. In the corporate literature, numerous companies have different accounting disclosure practices, the companies of banking and financial institutions have different disclosure norms, and the practices of dividend study may be different among the industries. This study used 11 years of financial data from 23 BSE S&P Healthcare Index companies. So, the study's results can be generalized to the particular industry or related industries alone. Moreover, the data depend on the trustworthiness of the prowess database. The study period is from 2016 to 2021; the adverse environmental factors may impact the results which may change when generalizing the results in other periods of the study. Therefore, future researchers can include more years and test the model by extending it to other industries in India and worldwide.

Another limitation of this study is the limited sample size. We could focus only on 23 companies (because we focused only on the companies that have been paying dividends continuously). Further, a cross-industry analysis would have been more helpful in enriching the results. It would also be interesting to study the relationships between the variables

from industries in different countries, and see if there are any marked differences with the relationships in the hypothesized model.

6.3. Conclusions

The present study developed a conceptual model and empirically examined the moderating role of firm age and firm size in the relationship of promoters' holdings, institutional holdings dividend payout ratio, and firm. The results indicate that firm age and firm size are the prominent moderators. In this research, the hypotheses tested are expected to contribute to the burgeoning theory of financial management. This study provides valuable insights for practicing managers in understanding the antecedents and boundary conditions for enhancing firm value. This study provides avenues for future research. It is suggested that future studies may focus on the role of other variables such as financial leverage and capital structure in influencing the value of the firm and dividend payout ratio, which may significantly contribute to the growing body of knowledge in finance.

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Impact of Leverage on Valuation of Non-Financial Firms in India under Profitability's Moderating Effect: Evidence in Scenarios Applying Quantile Regression

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Abstract: The firm's valuation (FV) is the key element for all stakeholders, particularly the investors, for their investment decisions. The main impetus of this research is to estimate the effects of the debt ratio (DR, i.e., leverage) on the FV (i.e., assets and market capitalisation) of the non-financial firms listed in India. The quantile panel data regression (QPDR) on the secondary data of 76 non-financial BSE-100 listed firms in India is employed. This study also checks the effect of the net profit margin (NPM) as profitability on the association between DR and FV. The QPDR estimates result in multiple quantiles and provide evidence in scenarios. The findings reveal a positive relationship of DR to assets only in higher quantiles, i.e., 90%ile), and a negative association of DR is found with a market capitalisation in all quantiles. Under the interaction effect, profitability (NPM) does not affect the association of DR with assets but negatively affects the association of debt ratio with market capitalisation in the middle (50%) quantile. The findings indicate that leverage (DR) affects a firm's value. The study's outcomes are helpful to all stakeholders, particularly investors, to realise the leverage (DR) as a critical indicator of FV before making any investment decisions. Managers should also consider lower debt ratios for better firm value. The present analysis is original and holds novelty in the form of the moderating role of the net profit margin, i.e., the profitability of the firm between DR and FV in the non-financial firm in India. To the best of our knowledge, no such studies have been performed to look for the association of the debt ratio with a firm's value under the effect of profitability in different quantiles using quantile regression.

Keywords: debt ratio; firm value; net profit margin; sales; profitability

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1. Introduction

In light of the recent global financial crises due to COVID-19, institutions have increasingly relied on financing loans for some of their transient assets. This situation has enabled them to satisfy their financial obligations, maintain a higher rate of return, and avoid going bankrupt. This kind of financial choice does not stop the catastrophe from happening; it merely delays it. This study investigates how the debt structures of non-financial firms listed on the BSE-100 affect their financial performance (as valuation). The debt structure is a crucial metric for assessing performance by the utilisation of resources to maximise earnings for its shareholders and raise the institutions' market value.

Even if there is a lack of funding, it is difficult for non-financial institutions to provide the required funding, and the management of these institutions in developing nations,

notably in the non-financial firm in India, is getting increasingly complex. A company's financial choice is significant because it affects current and future cash flows, profitability, and liquidity. Financial management's main objective is to make decisions to increase the organisation's competitive position while maximising owners' wealth (Abuamsha and Shumali 2022).

The capital structure (CS) influences not just the organisation's profitability but also its leverage ratios. The operating leverage often grows as fixed costs rise. As a result, firms must constantly cut fixed expenditures to avoid additional losses, particularly during times of crisis. The company's CS refers to the ratio of equity and debt resources utilised for funding the firm. Few ideas advocate that the directors' CS choice is crucial because the performance correlates with it. Financial leverage is the ratio of total debt to total capital employed. Hence, besides having a big impact on the organisation's profitability, financial problems caused by CS also substantially affect the macroeconomic results. Profit maximisation and the hazards involved must also be weighed in financial management. The company needs a financing structure that guarantees better profitability and market value. CS and DR impact the company's profitability.

Various studies find the connectivity of leverage with a firm's performance in terms of valuation. Research such as that of Ruland and Zhou (2005), Abor (2005), Tayyaba (2013), and Robb and Robinson (2014) has shown a favourable effect on performance. Cheng and Tzeng (2011), Negash (2001), Phillips and Sipahioglu (2004), and Rahman et al. (2020), however, argue that leverage deteriorates the firm's performance. Lin and Chang (2011) indicate no significant connection between leverage and FV. This situation raises the issue of having fresh evidence of the leverage effect on valuation.

In Indian context, it is evident that Indian corporate has seen several corporate reforms, including the implementation of many rules and regulations like various company acts. The recent one is Company Act 2013 to enhance corporate performance in India. As discussed earlier, leverage is an essential component in a company's capital structure. Valuation is also a key element for an investor's decision to invest in a firm. However, its impact on a firm's valuation is inconclusive. Mainly, the research on such a topic is concentrated in developed economies. Emerging economies like India (one of the fastest-growing economies) need fresh evidence, as several regulatory reforms have been witnessed in this fast-growing economy. Therefore, it is high time to estimate the leverage effect on FV of non-financial firms in India and to provide novel evidence.

In order to answer the primary question addressed in this paper, we use panel data analysis (PDA) to validate the given hypotheses. The rationale for utilising a PDA is that it features cross section and time. Panel data analysis has a wide range of applicability in finance and economics. The quantile panel data regression (QPDR) model (Graham et al. 2015) is employed for regression analysis. This approach is also advantageous because it can better deal with the endogeneity problem. As a result, endogeneity in such models is not a significant difficulty in generating consistent results and proving our objectives. We intend to find the connection between DR and FV (assets value and market capitalisation taken as a proxy of firm value). In this study, NPM is used as a proxy for firm profitability. As a result, the initial analysis omits the relationship between DR, FV, and the moderation impact of business profitability. First, the direct effect of DR on FV may be harmful. If the indirect relationship between DR and FV prevails, analysing profitability as a moderator for the firm value could elaborate on the varied repercussions of the effect of DR on FV. Second, by including sales, "Profit Before Interest And Tax" (PBIT), and "return on assets" (ROA) as control variables, we would be able to make a compelling case for finding the sole impact of DR on valuation and impact in interacting with profitability.

Thus, this paper makes a new contribution to the literature. This study represents a remarkable effort to find the moderating role of the net profit margin, i.e., profitability of the firm between DR and FV in the non-financial firm in India. To the best of our knowledge, no prior study has examined the impact of profitability's moderating role on the linkage between DR and FV.

The advantage of our empirical approach, the panel data analysis using quantile regression, is that it enables us to investigate the contingent roles of leverage on valuation in different scenarios (quantiles). This situation provides deeper insights into the connection between the two to have better decision-making inputs. In this paper, we argue that the sales, profit before interest and tax, and return on assets play a crucial contingent role in a firm's valuation. The justification for using sales, PBIT, and ROA as control variables come from the literature-supported evidence of an empirical association between DR and FV (Abidin et al. 2021; Ullah et al. 2020; Nariswari and Nugraha 2020). Overall, our article suggests an adverse correlation between DR and FV. The current findings give clear implication to focus on portfolio diversification and diversified capital structure.

The remainder of the paper is organised as follows. The following section provides a full literature review, while Section 3 provides data and the research methodology. Section 4 offers the empirical results, briefly discussing the reason for adopting a thorough empirical analysis. Section 5 analyses the empirical findings, while Section 6 provides a summary and implications. The final portion finishes with suggestions for future study extensions.

2. Literature Review

2.1. Debt Structure and Financial Performance

While examining how an organisation's debt structure affects its financial performance (FP), Modigliani and Miller (1958) concluded that FP was unaffected. They asserted in a subsequent study, however, that due to high taxes and deductible interest rates, these organisations prefer to finance with debt rather than equity (Modigliani and Miller 1963), which is consistent with the trade-off theory, which holds that debt gives an organisation a tax advantage (Akeem et al. 2014). As a result, the corporation should take on more debt to improve performance, which will lower taxes and boost ROA (Saif-Alyousfi et al. 2020). This viewpoint is also supported by Nirajini and Priya (2013). Homapour et al. (2022) studied British firms, and they found that leverage improves the market performance of stocks and reduces market risk (financial). Since this study aims to empirically test the DR and FV nexus with a moderation influence on profitability, our examination of the literature will focus on this study area.

Leverage or debt ratio and FP have been the subject of several prior empirical investigations. The results of these investigations are blended. On one side, specific researchers such as Ruland and Zhou (2005), Abor (2005), Tayyaba (2013), and Robb and Robinson (2014) discovered the connection between FP and leverage. According to Robb and Robinson (2014), using debt boosts FP resulting in greater returns than the average interest costs associated with a firm's leverage. These findings can be justified in light of earlier, significant studies like those of Modigliani and Miller (1958) and Ruland and Zhou (2005), which asserted that profitable companies advertise quality by raising their leverage. This situation leads to the positive connectivity of profitability to leverage. The research of Saleem et al. (2013) and Tripathy and Shaik (2020) on a South Asian Oil and gas firm investigated how leverage impacts profitability. The study concluded that financial and operating leverage considerably impact the profitability ratios. Rahman et al. (2020) aimed to investigate how the DR affects a sample of Pakistani enterprises' financial results. Some showed that leverage has a detrimental effect on FP, including Cheng and Tzeng (2011), Negash (2001), and Phillips and Sipahioglu (2004), while others indicated no link between leverage and business success. According to Cheng and Tzeng (2011), the level of leverage results in agency issues that indicate a weak connection between leverage and FP. Lin and Chang (2011) found two threshold effects between leverage and FP, using debt as a threshold for Taiwanese enterprises. A rise in leverage is followed by an improvement in FP as determined by Tobin's Q if the DR is low. There is no proof of a connection between leverage and FP when it is high. As in past studies, the debt ratio is used as a threshold, which evaluates the connectivity of leverage to ROE, the Vietnamese firms' metric of firm success.

Many studies examined the connection between leverage and ROE, their measure of business performance, and the relationship between company size and FP in India and other developing countries. Pandey and Ponni (2017) analysed how CS affects the performance of listed Indian companies, focusing on the pharmaceutical industry. A similar study conducted in Nigeria (Onaolapo and Kajola 2010; Chen et al. 2019) supported the agency costs theory's claim by showing how a high debt ratio significantly negatively impacts FP indicators like ROA and ROE.

Goel et al. (2022) used debt financing as a substitute for CS and profit efficiency as a substitute for business success in order to analyse the impact of CS on industrial performance in India. These findings, consistent with past research, demonstrate little correlation between performance and debt financing. By simulating the CS with debt and the FP with ROA and return on capital employed (ROCE), it is possible to examine the CS and FP of Sri Lanka's listed companies (Pratheepkanth 2011; Yinusa et al. 2021). The results show that there is a bad correlation between leverage and FP. Hence, increasing debt has a negative impact on the FP of the organisation.

No research has yet been conducted on the possible influence of profitability (NPM) on the impact of DR on firm value. We propose to bridge this gap in the literature by employing a more open-ended empirical definition that permits a wide range of potential relationships between the debt ratio and firm value.

2.2. Profitability, Leverage and Firm Value

High profitability suggests positive business prospects, and investors will take these signals favourably, increasing the firm's worth. This situation makes sense because a firm's ability to produce higher profits suggests that the company is performing well, which encourages investors to be optimistic and drives up the company's stock price. The company's value rises along with market stock prices. According to Terpstra and Verbeeten's (2014) research, profitability ratios—measured by ROI or ROA—significantly impact the company's value.

A company's total assets, which comprise its resources, are used to calculate ROA, a profitability metric. This ratio shows how well management uses the total assets to produce profits. The ROA informs the business of the profits from the capital invested (assets). The ROA varies from company to company and throughout industries; therefore, using it as a comparative indicator should be done cautiously, taking into account the company's performance history and comparing it to that of rivals and similar businesses in the same industry (Habib et al. 2016).

A combination of debt and equity is used to finance the firm's assets and fund the business's operations. The ROA gauges how successfully an organisation converts invested capital into net income during operations. High ROA indicates better resource utilisation, translating into higher FP (Gibson 2012).

When assessing a company's ability to produce shareholder value, investors look at metrics including ROA, debt-to-asset ratio (DAR), current ratio (CR), firm size, and dividend payout ratio (DPR). While establishing an FV, profitability is an important consideration. The profitability metric is the ROA. An indicator of the contribution that assets contribute to net income is the ROA ratio (Ullah et al. 2020). ROA impacts FV, according to (Phuong et al. 2020). A significant profit indicates promising corporate futures, encouraging investors to enhance stock demand and raising firm value.

Operating leverage is influenced by the number of fixed costs; hence, a higher percentage of fixed costs denotes significant operational leverage. As a result, operating income will fluctuate with every change in sales. Also, the organisation may be exposed to risk due to the substantial operating leverage. Regardless of the business's sales, fixed expenses must be paid, including manufacturing overhead, equipment depreciation, and maintenance costs (Gitman and Zutter 2015).

Investors must take into account a company's size when estimating its worth. Thakur and Workman (2016) claim that a company's sales, capital, and total assets can be used to

estimate the business size. Compared to firms with small total assets, those with large total assets are mature and can create good prospects in a time of relative stability and can turn a profit.

Mutmainah (2015) asserts that a company's size can be estimated using its sales, total assets, or capital. Firms with higher total assets have matured and are seen as having good prospects in an era of stability and the capacity to generate profits. When a corporation has a large overall asset base, the management has numerous preferences for how the assets should be used (Davydov 2016). From the management perspective, the value of the business will increase due to how easily it can be managed (Rajgopal and Venkatachalam 2011). Nurainy et al. (2013) also support this perspective, which discovered that firm size significantly affects firm value.

According to Darsono et al. (2011), total assets turnover (TAT) is an activity ratio that signals how much of an FV is employed to complete or provide sales (Bahraini et al. 2021). The more effectively all of the FV is employed to produce net sales, the higher the total assets turnover, which leads to better revenue and profit. Profit growth is a metric used to assess an FP; as a result, the higher the profit, the more successful the organisation. Thus, profit growth will be more significant if the total asset turnover is high. The results of in dicate that TAT favours company profit growth.

Profitability gauges the money from a transaction or investment (Liao et al. 2020). It also demonstrates the management's capability to boost company profits or as a barometer for effectiveness. High profitability indicates the business's promising future for investors Profitability has a significant effect on the security and liquidity of the financial system. Investors should therefore take the company's financial liquidity into account when assessing a company's profitability. Investors increasingly consider financial security and profitability levels when making long-term investments.

The extant literature discussed above exhibits that the connectivity of DR and the firm's value is inconclusive. The relationship of leverage and valuation under the moderating role of dividend policy (Fajaria and Isnalita 2018) and corporate governance (Javeed et al. 2017) was investigated and found to be significant. However, the moderating effect of profitability has not yet been examined for the DR and firm's value connection. In addition, it is also observed from the extant literature that studies exploring DR and valuation relationships are highly inclined towards developed economies. In the Indian context, such studies are rarely found. Hence, this study fills the research gap with its novel approach to deliver fresh evidence on the association of DR and the firm's value of firms in India. This study considers specific profitability measures like Sales, PBIT, and ROA as control variables to observe the sole effect of leverage on valuation (Abidin et al. 2021; Ullah et al. 2020; Nariswari and Nugraha 2020). The above discussion expresses how these factors can influence leverage and firm value. Therefore, variables such as sales, PBIT, and ROA should be kept controlled to handle omitted variables biasedness. As these profitability factors are controlled, we chose a more robust profitability measure, i.e., NIM, to moderate the DR and valuation.

2.3. Theoretical Underpinnings for the Impact of Debt Ratio and Firm Value

According to Modigliani and Miller (1958), their modern capital structure theory posits that the firm's value is not affected by financial structure. However, in their advanced theory, Modigliani and Miller (1963) assert that leverage improves a firm's value due to the tax shield advantage. Modigliani and Miller (1963) argue that when leverage cannot build a tax shield advantage, it adversely affects a firm's value by increasing the leverage cost. Similarly, the trade-off theory says that leverage is detrimental to a firm's value because it creates financial instability in firms (Homapour et al. 2022; Cheng and Tzeng 2011).

Nobel Prize winners Modigliani and Miller's (1958) work, which was previously described, was the first quantitative analysis of the impact of a company's capital structure on its financial indicators (Brusov et al. 2022). The conventional strategy, founded on an investigation of empirical data, was in use prior to their work. The Modigliani–Miller

theory became a particular instance of the modern Brusov–Filatova–Orekhova (BFO) theory (Brusov et al. 2022; Brusov et al. 2023; Brusov and Filatova 2023), which was created in 2008. Many qualitatively novel effects missing from the Modigliani–Miller theory have been found in the BFO hypothesis. BFO theory (Brusov et al. 2018; Brusov and Filatova 2023) demolished some of the most fundamental financial management ideas. They considered the company's perpetuity (finite lifespan) as crucial. Therefore, no standard view is observed among researchers. It is also argued that BFO theory under inflation increases the firm's cost of capital and FV. Therefore, leverage decreases the firm's value (Brusov et al. 2022).

The percentage of a company's total debt to its assets is known as the debt ratio, according to Siahaan et al. (2016). As the debt ratio increases, the source of funding through debt reduces. On the other hand, the amount of debt used to finance a project increases with the debt ratio. Financial leverage and company performance in Tanzanian savings and credit cooperative societies were examined using the literature (Towo 2022; Luu 2021), and both were discovered to be significantly and negatively linked. The same findings were also demonstrated by Nigerian product companies, which reported their performance by the added cash value of listed industrial good firms and revealed a negative link with long-term DR while displaying a positive correlation with short-term DR (Ofulue et al. 2022; Akhtar et al. 2016). Regarding the CS effect on family business performance in corporate governance, family-owned businesses with limited resources see a fall in investment opportunities, while more opportunities emerge due to debt. Itan and Chelencia (2022) and Selim et al. (2022) found that savings- and credit-cooperative societies' leverage and FP in Tanzania's financial leverage impacted the success of credit-cooperative societies. A study of Nigerian oil corporations found negative connectivity of leverage and FP as assessed by ROE, and it was proposed that debt financing be increased to secure shareholders' positions in firms (Huynh et al. 2022; Abubakar 2015; Ehikioya 2009; La Rocca 2010; Kalantonis et al. 2021). In a study on British firms, Homapour et al. (2022) advocated that leverage improves a firm's market value and reduces risk. With the above discussion, this study hypothesises the following in its alternate form:

H1. *Debt ratio negatively affects firm value.*

2.4. Theoretical Underpinnings for the Effect of Profitability (NPM) on Debt Ratio and Firm Value Connection

The net profit margin is the portion of revenue made up of net income or profit. A company's or industry's net profit margin is determined by the proportion of net earnings to revenues. Net profit margins are often reported as a percentage. Divide net income by sales to obtain this ratio (Gibson 2012; Rahman et al. 2020). The net profit of margin is a proportion of profitability that contrasts net income to sales. Exposing operational expenses over a given period helps evaluate how efficient a company is (Dakua 2019). The better the net profit margin, the more likely a company is to produce a sufficient profit from sales to allow it to reduce its operating costs successfully. The results of Royda (2019) show that NPM has no discernible effect on a company's growth in earnings. The research results by (Puspasari et al. 2017) show that the NPM effect is positive and significant for firm profit growth. It was observed in several studies, such as (Phuong et al. 2020; Ullah et al. 2020), that profitability improves firm value. However, the mediating role of profitability has not been examined for the DR and FV nexus. Hence, the following alternate hypothesis is made:

H2. *Profitability (NPM) moderates the relationship between Debt ratio and firm value.*

3. Data and Methodology

3.1. Data

This study used the secondary data of 76 BSE-100 listed non-financial firms in India. The sample period of study is ten years (2011–2020). The data initially included 100 firms. However, it was reduced to 76 firms after the data filtration. The financial firms were excluded due to their different approach to reporting having different features. The study found 76 firms with authenticated data for a balanced panel for consistent results. In addition, the chosen period must be investigated after the reform period and recent regulatory measures regarding India's corporate activities, for instance, the recent amendment in the Companies Act 2013 and Insolvency and Bankruptcy Code 2018.

Additionally, the sample period size has enough observations to deliver more substantial and reliable evidence. The data source is the Bloomberg database, from which data retrieval was performed. The industry-wise distribution of firms is shown in Table A1 in Appendix A. The variables for which data were procured are mentioned and described in Table 1.

Table 1. Variables.

Variable	Measurement	References
Explanatory Variables (EV)		
Debt Ratio (DR)	It represents the share of debt to total assets. A higher debt ratio shows that the firm is highly leveraged. It is calculated as DR = total debt/(debt + equity)	Husna and Satria (2019); Irman and Purwati (2020)
Dependent Variables (DV)		
Asset (lasset)	It is the total value of a company's assets. The Asset value is taken as one of the proxies for firm value. lasset shows logarithmic value is taken.	Husna and Satria (2019); Irman and Purwati (2020)
Market Capital (lmcap)	Market capitalisation (Mcap) is taken as another proxy of firm value. It is calculated as mcap = (Total outstanding shares) × market value of a share. lmcap shows logarithmic value is taken.	Al-Ahdal et al. (2020); Garcia et al. (2019)
Tobin's Q (TQ)	It is the ratio of firm's value and firm's assets replacement cost (ARC). TQ = FV/ARC	Vo (2017)
Market-to-Book Ratio (MTB)	It is the ratio of market value (MV) and book value (BV) of a firm's equity share. MTB = MV/BV	Vo (2017)
Enterprise value (ENTV)	It is calculated by the sum of market cap and net debt. ENTV = Mcap/Net Debt	Hao et al. (2022); Ronald and Semuel (2022)
Return on Equity (ROE)	It also indicates the profitability of banks, and it is positively related to profitability. It is calculated as ROA = net income/total equity	Hao et al. (2022); Ronald and Semuel (2022)
Moderating Variables (MV)		
Net Profit Margin (NPM)	It is used as the proxy for profitability. The higher NPM is an indication for higher profitability.	Nariswari and Nugraha (2020); Panjaitan (2018)
Control Variables (CV)		
Sales (lsales)	It shows the total value of sales in a firm. lsales indicates logarithmic value is taken for analysis.	Ohiomah et al. (2020); Blal et al. (2018)
PBIT (lpbit)	It is profit earned by a company before interest and tax. lpbit indicates that the logarithmic value is taken for analysis.	Nariswari and Nugraha (2020)
Return on assets (ROA)	It also indicates the profitability of banks, and it is positively related to profitability. It is calculated as ROA = net income/total assets	Husna and Satria (2019)

Note: The Variables' data is sourced from Bloomberg database.

3.2. Methodology

The data used for this study include both cross-sectional units (76 firms) and a time dimension of ten years (2011–2020). Therefore, we performed the panel data analysis (PDA)

to verify the assumed hypotheses in this paper. The rationale behind using PDA is its benefits of featuring both cross section and time. Hence, it delivers comparatively more information to justify the findings (Hsiao 2007; Baltagi 2008). PDA is less susceptible to endogeneity complexities. Hence, PDA results are comparatively less biased than typical time series or cross-sectional studies (Kanoujiya et al. 2022; Wooldridge 2015). Furthermore, the quantile panel data regression (QPDR) model (Graham et al. 2015) is used for regression analysis because the dependent variables are found to be non-normal. As the dependent variable is non-normal, the extent of the effect might vary in different quantiles (Kanoujiya et al. 2022; Hettmansperger and McKean 2011; Asmare and Begashaw 2018). Thus, the QPDR model becomes a good fit for finding results in scenarios (Kanoujiya et al. 2022; Hettmansperger and McKean 2011; Asmare and Begashaw 2018). The QPDR model is also advantageous, as it can better deal with the endogeneity problem. Hence, endogeneity in such models is not a big issue in delivering consistent results (Kanoujiya et al. 2022; Wooldridge 2015). The model specification is mentioned below:

$$DV_{it}(\tau) = \theta_1 DR_{it} + \theta_2 lsales_{it} + \theta_3 lpbit_{it} + \theta_4 ROA_{it} \quad (1)$$

$$DV_{it}(\tau) = \theta_1 DR_{it} + \theta_2 NPM_{it} + \theta_3 i\_DR\_NPM_{it} + \theta_4 lsales_{it} + \theta_5 lpbit_{it} + \theta_6 ROA_{it} \quad (2)$$

Base models (Model 1 and 2) are based on Equations (1) and (2), corresponding to the interaction models (Model 3 and 4), where the dependent variable (DV) is the firm's value and has two proxies, i.e., lasset and lmcap. Two additional proxies of DV are also taken, namely, TQ and MTB. Both are incorporated to check the results' robustness. The main explanatory variable is the debt ratio (DR). This study also investigates the interaction effect of DR under the moderation of profitability. Hence, the interaction term calculated as (i_DR_NPM [=dDRXdNPM]) is also introduced, including DR as the main explanatory variable and NPM (profitability) as the moderator. Suffix 'd' shows that demean values are taken. In addition, three control variables are also included in the models (i.e., lsales, lpbit, ROA) to obtain a good fit model to determine the sole relationship between the variables of interest. 'it' shows that PDA model specification is taken where 'I'm is cross-sectional units (firms) and 't' is time (year). 'θi' is the coefficient estimate.

3.3. Quantile Regression

Most of the prior studies employ parametric methods to examine how leverage and FV are related. There is evidence in the literature that the effect size may vary with quantiles when the outcome variable is non-normal. The FV-having proxies lasset and lmcap are the dependent variables of interest in this study and are non-normal. A discussion on non-normality checks is provided in Section 4.2.

As mentioned in Section 4.2, lasset and lmcap are not normally distributed. Therefore, we use a quantile regression model to examine the relationship between leverage and FV. In addition, research that supports non-parametric methods is the inspiration for implementing quantile regression since it yields better results in empirical examinations of scenarios (see Asmare and Begashaw 2018; Hettmansperger and McKean 2011). Additionally, quantile regressions and other non-parametric methods do not make any assumptions about the model's error component distribution.

We use Graham et al. (2015) estimator, known as quantile regression for panel data (QRPD), which is based on Ledhem and Mekidiche's (2022) work. As the best non-parametric strategy, we combine QRPD with Markov chain Monte Carlo optimisation (MCMC) to address the difficulties with conventional calculation mistakes. Additionally, according to Dong et al. (2015), one of the effective non-parametric techniques for robust estimation for quantile regression is MCMC. Quantile regression is also more resistant to data outliers and less susceptible to them. Lastly, by assessing the effect at various quantiles of FV, the non-parametric method of QRPD with MCMC optimisation allows for more exploration of leverage. Thus, QRPD is a consistent and justifiable approach for this study.

Additionally, when the data are non-normally distributed, then the classical regression approach does not provide clearer insight for the association of the two variables. Hence, looking at their relationship in different quantiles gives clearer insights to have a better decision-making approach.

3.4. Variables

The dependent variable in this study is the firm's value. The firm's value is proxied by lasset and lmcap. The lasset is the total value of a firm's asset in INR (Husna and Satria 2019; Irman and Purwati 2020). The logarithmic value is taken to handle extreme value vulnerability. The lmcap is the market value of the firm's total outstanding shares (Al-Ahdal et al. 2020; Garcia et al. 2019) (see Table 1 for description). This study also includes two more proxies of FV. These are "Tobin's Q" (TQ) and the "market-to-book ratio" (MTB). They are incorporated to ensure the results' robustness. TQ is the ratio of FV and assets replacement cost (Zhao and Murrell 2016; Vo 2017). MTB is the ratio of the market value and book value of a firm's equity share (Zhao and Murrell 2016; Vo 2017).

The primary explanatory variable is the debt ratio, which describes the firm's leverage status (Husna and Satria 2019; Irman and Purwati 2020). Table 1 has a note on it. Profitability is the moderating variable to find the effect of DR on the firm's value. NPM is taken as the proxy of profitability (Nariswari and Nugraha 2020; Panjaitan 2018). Three variables (lsales (Ohiomah et al. 2020; Blal et al. 2018), lpbit (Adelopo et al. 2018; Nariswari and Nugraha 2020), and ROA (Adelopo et al. 2018; Husna and Satria 2019)) which seem to affect the firm's value are kept controlled to obtain a good-fit model to determine the effect of DR on a firm's value, reasonably. Table 1 demonstrates detailed notes on the variables incorporated in the study.

4. Results

4.1. Summary Statistics

Table 2 gives the summary of descriptive statistics. The firm's asset value has an average value of INR 50,502.44 million. However, it is quite downward from Min. Therefore, on average, the firm's value in India is low. Similarly, the firm's market capital has an average value of INR 71,009.26 million, which is also closer to Min, indicating a low market capital (on average) of firms in India. However, it should be noted that the standard deviation is relatively high. This result shows that firms vary in terms of firm's value.

Table 2. Summary statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
DVs					
Asset (lasset)	760	50,502.44	10,0946.97	276.45	1,165,910
Mcap (lmcap)	760	71,009.26	101,625.92	52.22	1,017,464.4
EVs					
DR	760	0.177	0.195	0.00	0.896
MVs					
NPM	760	0.404	3.200	−0.729	78.51
CVs					
Sales	760	38,695.23	77,530.75	61	615,782.6
Pbit	760	4923.03	7999.67	−39,637.4	57,244
ROA	760	11.58	9.49	−20.44	77.61

Note: Min, Max, Obs., and Std. Dev. are minimum value, maximum value, number of observations, and standard deviation, respectively. DVs are dependent variables. EVs, MVs, and CVs are the explanatory, moderating, and control variables, respectively.

Additionally, it is also found that these 76 sample firms share 71.67% of the market capitalisation of all BSE 100 firms. The DR (debt ratio) exhibits its average value of 0.177, closer to Min. Hence, on average, the leverage in the sample firms is low. Additionally, the

sample firms vary less regarding leverage, as their SD is relatively low. The mean value of NPM is 0.404, which is positive but notably down compared to Min. Hence, the firms are found to be in profit (on average), which is fairly low. The SD of NPM is low; hence, the firms are not much differentiated regarding profitability (NPM). The average sales in sample firms are INR 38,695.23 million (closer to Min). Hence, a signal for low sales (on average) in the sample firms is found.

Similarly, the PBIT has an average value of 4923.03 (in million INR). It is optimistic, but it is closer to Min. Hence, on average, a low PBIT is found. However, sales and PBIT have high SD, indicating the varying nature of firms in terms of sales and PBIT. The ROA of sample firms with an average value of 11.58 shows a low ROA due to having proximity towards Min. Its SD is slightly low; hence, firms are not much varying when considering ROA.

4.2. Normality of Dependent Variable

Table 3 demonstrates the normality status of the data used for dependent variable proxies. The Shapiro–Wilk test tests the normality with the null of non-normal data. The significant outcomes for both proxies confirm that the dependent variable proxies are not standard in distribution. Hence, the application of QPDR is reasonably justifiable. Additionally, the QPDR estimates the regression results in different quantities; hence, it helps analyse the outcomes' robustness.

Table 3. Shapiro–Wilk W test.

Variable	Obs	W	*p*-Value	H0: Data Normally Distributed	Outcome
lasset	760	0.992	0.000	Rejection of H0	Non-normal Data
lmcap	760	0.976	0.000	Rejection of H0	Non-normal Data
ENTV	760	0.974	0.000	Rejection of H0	Non-normal Data
ROA	760	0.884	0.000	Rejection of H0	Non-normal Data
ROE	760	0.445	0.000	Rejection of H0	Non-normal Data
TQ	760	0.246	0.000	Rejection of H0	Non-normal Data
MTB	760	0.454	0.000	Rejection of H0	Non-normal Data

Note: The Shapiro–Wilk W test to check normality of data of dependent variable. It has the null of normal distribution. ENTV, ROA, ROE, TQ, and MTB are other proxies taken for valuation to check results' robustness as described in Appendix A.

4.3. Multicollinearity

The correlation matrix shown in Table 4 has a pairwise correlation coefficient. It can be observed that there are many significant correlations between pairs. However, no significant correlation has a value greater than 0.80. This situation indicates that multicollinearity is not available in the models. Moreover, the VIF values (in Table 5) of all variables used in the study are not more than '3'. This result also ensures that multicollinearity is not available in models.

Table 4. Correlation matrix.

	lasset	lmcap	DR	NPM	lsales	lpbit	ROA
lasset	1						
lmcap	0.638 *	1					
DR	0.265 *	−0.051	1				
NPM	0.037	0.059	−0.047	1			
lsales	0.608 *	0.407 *	0.306 *	−0.043	1		
lpbit	0.681 *	0.764 *	0.070	0.087 *	0.612 *	1	
ROA	−0.230 *	0.169 *	−0.462 *	0.373 *	−0.185 *	0.091 *	1

Note: * signals *p*-value significance at 0.05.

Table 5. Variance inflation factor (VIF).

Variable (DV:lasset)	DR	NPM	lsales	lpbit	ROA	DR NPM
VIF	1.542	1.230	1.649	1.496	1.544	1.246
Variable (DV:lasset)	**DR**	**NPM**	**lsales**	**lpbit**	**ROA**	**DR NPM**
VIF	1.543	1.230	1.650	1.497	1.544	1.246

Note: VIF < 3 shows no multicollinearity.

4.4. Regression Results

Tables 6 and 7 demonstrate the regression results of QPDR analysis. Table 6 shows the results of base models (Models 1 and 2). In Model 1, it is evident that 'DR' is insignificant in the first two quantiles (i.e., at 10%ile and 50%ile). However, it is both significant (at 5% significance) and optimistic, with a value of 1.309 in the 90%ile. It indicates that DR positively affects lasset (firm's value) at the 90%ile (higher quantile). The control variables lsales and lpbit are both significant and positive at the 10%ile % and 50%ile %. The control variable ROA is found negative at all quantiles. However, the lsales is insignificant in the 90%ile quantile. In Model 2, DR is found significant and negative in all three quantiles (10%ile, 50%ile, and 90%ile). Hence, it implies that DR is detrimental for the firm's market capitalisation (lmcap). The control variable 'lsales' is found significant and negative in the 10%ile and 50%ile. However, it is insignificant in the 90%ile. 'lpbit' is significant and positive in all quantiles. However, ROA is insignificant for lmcap in all quantiles.

Table 6. Results of quantile regressions (with base variable).

		lasset			lmcap		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−0.093	0.261	0.721	−2.103 *	0.348	0.000
	lsales	0.133 *	0.047	0.005	−0.124 ***	0.072	0.088
	lpbit	0.799 *	0.069	0.000	0.975 *	0.076	0.000
	ROA	−0.413 *	0.027	0.000	−0.029	0.062	0.637
Quantile (50)	DR	0.094	0.102	0.358	−1.151 *	0.148	0.000
	lsales	0.058 *	0.021	0.006	−0.069 *	0.018	0.000
	lpbit	0.941 *	0.021	0.000	0.768 *	0.022	0.000
	ROA	−0.646 *	0.018	0.000	0.011	0.025	0.648
Quantile (90)	DR	1.309 **	2.144	0.032	−0.737 **	0.262	0.005
	lsales	−0.031	−0.214	0.830	0.003	0.031	0.918
	lpbit	0.719 *	4.770	0.000	0.643 *	0.034	0.000
	ROA	−0.415 **	−2.854	0.004	0.045	0.039	0.244

Note: *, **, and *** are for *p*-value is significant at 1%, 5%, and 10%.

While considering the interaction effect in Model 3 (Table 7), DR has an insignificant coefficient in all quantiles in the case of lasset. The moderating variable NPM in the 10%ile and 50%ile is insignificant for lasset but significant and positive in the 90%ile. The interaction term (i_DR_NPM) is insignificant in all quantiles. It means that NPM (profitability) does not affect the association of DR with lasset. The control variable 'lsales' is found significant only in the 50%ile at 5% significance. Other control variables, 'lpbit' and 'ROA', are significant in all quantiles. However, lpbit is positive and ROA is negative. In Model 4, DR has a negative and significant coefficient (−1.610 and −1.044, respectively) in the 10%ile and 50%ile. However, DR is insignificant for lmcap at the 90%ile. It means DR is detrimental to a firm's value in terms of market capitalisation. The interaction term (i_DR_NPM) is negative and significant at the 50%ile. It implies that NPM (profitability) as moderator affects the relationship between DR and lmcap (market capital). Moreover, the negative coefficient indicates that while profitability is high, DR decreases the firm's

market capitalisation. 'lsales' and 'lpbit' are significant at the 10%ile and 50%ile. However, ROA is insignificant in all quantiles. Moreover, looking at all the models, 'lmcap' has exhibited more consistent outcomes in different quantiles. Hence, it can be a more reliable choice of the valuation measure of a bank. Furthermore, it is also evident that exploring the association of the two variables in different quantiles gives a clear indication that firms with higher valuation may exhibit different connectivity with leverage compared to lower-valuation firms.

Table 7. Results of quantile Regressions (with Interaction Variable).

		lasset			lmcap		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−0.002	0.370	0.994	−1.610 *	0.466	0.000
	NPM	0.053	0.087	0.541	−0.082	0.118	0.486
	i_DR_NPM	−0.428	1.390	0.758	−0.894	1.077	0.407
	lsales	0.112	0.088	0.202	−0.350 **	0.114	0.002
	lpbit	0.832 *	0.077	0.000	1.187 *	0.108	0.000
	ROA	−0.417 *	0.043	0.000	−0.019	0.057	0.727
Quantile (50)	DR	−0.026	0.181	0.882	−1.044 *	0.159	0.000
	NPM	0.063	0.115	0.582	−0.011	0.019	0.531
	i_DR_NPM	0.126	0.629	0.841	−0.269 **	0.133	0.044
	lsales	0.089 **	0.045	0.050	−0.122 **	0.042	0.004
	lpbit	0.902 *	0.043	0.000	0.820 *	0.042	0.000
	ROA	−0.670 *	0.019	0.000	0.016	0.035	0.635
Quantile (90)	DR	0.800	1.026	0.436	−0.977	2.684	0.715
	NPM	0.429 **	0.205	0.036	−0.011	3.438	0.997
	i_DR_NPM	−1.613	2.837	0.962	0.444	9.500	0.962
	lsales	0.186	0.322	0.562	0.018	0.614	0.976
	lpbit	0.578 **	0.284	0.042	0.630	0.621	0.310
	ROA	−0.698 *	0.116	0.000	0.056	0.132	0.671

Note: *, **, and *** are for *p*-value is significant at 1%, 5%, and 10%.

4.5. Robustness Test of Results

This study performs the robustness test to ascertain the robustness of the results. The quantile regression is performed, which estimates the impact of DR on the firm's value at different quantiles. Hence, it gives results in various scenarios. In addition, a multi-model approach is adopted, incorporating two proxies of the dependent variable and estimating the association of DR with the firm's value in the simple base establishment and under the moderating effect of profitability (Kanoujiya et al. 2022; Rastogi and Kanoujiya 2022). The study finds the effect of DR on a firm's value in many cases. Additional analysis is performed using five more proxies (i.e., TQ (Tobn's Q), MTB ("market-to-book ratio"), "enterprise value", ROA, and ROE) of a firm's value to further ensure the results' robustness. A complete discussion on this analysis is elaborated in Appendix B (discussed under Appendix B and results are presented in Tables A2–A5). Here again, very similar results are obtained. Hence, it confirms the results' robustness as found in the main models (Kanoujiya et al. 2022; Rastogi and Kanoujiya 2022).

5. Findings and Discussion

5.1. Hypothesis Discussion

This study formulated two main hypotheses. The first hypothesis is that the debt ratio negatively affects the firm value. Significant evidence is obtained in support of this hypothesis. We also found a negative association of debt ratio with a firm value under the effect of profitability (npm) at the 50%ile. Hence, the support for the second hypothesis, profitability, moderates the association of DR and FV. The current findings support the trade-off theory (Cheng and Tzeng 2011), which asserts the negative relationship of leverage and firm value. However, the findings do not support modern capital structure theory

(Modigliani and Miller 1958). It is to be noted that a positive impact of leverage on assets is found only at a higher quantile (90%ile). It also supports Modigliani and Miller (1963) for their advanced theory, indicating that leverage does not carry tax shield benefits; instead, it incurs cost in the leverage of Indian firms. The current findings also support modern capital structure theory, i.e., BFO theory, as discussed in the literature.

5.2. Comparison of Previous Findings

Current results differ from the previous studies that the debt ratio positively affects a firm's value (Modigliani and Miller 1958; Siahaan et al. 2016; Huynh et al. 2022; Abubakar 2015; Ehikioya 2009; La Rocca 2010; Kalantonis et al. 2021). However, the results are in support of the research by Towo (2022), Luu (2021), and Cheng and Tzeng (2011). They conclude that leverage is detrimental to a firm's value. Some studies found mixed effects because the relationship between the debt ratio and firm value varies with changes in the debt structure (Al-Ahdal et al. 2020; She and Guo 2018). It can be concluded from the results shown that the interest tax shield grows as the debt ratio rises, but the costs associated with leverage rise as well, counteracting the beneficial impacts of the debt ratio on the firm value.

5.3. Contribution and Implications

The current study presents the association of leverage with a firm's valuation. It is found that leverage negatively impacts the valuation solely (all quantiles) and under the interaction of profitability (in the middle quantile). The current study augments the literature on leverage and valuation in several ways. First, it provides fresh evidence on the association of leverage and the valuation of non-financial firms in India. Second, it employs a more consistent approach (quantile regression) to reveal this relationship in different scenarios. Hence, the findings provide more profound insights into the impact of leverage on valuation. Third, it also looks for their association under the interaction of profitability. To the authors' belief, such research rarely exists in the literature. Hence, the current evidence makes a significant contribution to the literature.

The findings bring several noticeable implications for all the stakeholders to see the leverage in connection with valuation critically. It is not always the case that it benefits the firm's value. Hence, the finance manager needs to take care of the firm's debt structure while looking for its involvement in the capital structure. They should be alerted to the inclusion of debt and critically evaluate that it does not cause much cost to the firm. The important implication for investors is that firms with a higher share of debt might not be suitable for the firm's valuation. Therefore, leverage should be seen critically for any investment decisions. Additionally, the findings give noticeable implication to focus on portfolio diversification.

6. Conclusions

Leverage is one of the essential elements in a firm's capital structure. This paper aimed to determine the impact of debt ratio on the firm value of 76 non-financial firms listed in BSE-100 in India. Applying QPDR, it was found that a firm's leverage ratio adversely affects its valuation in India. The profitability (NIM) negatively affects the impact of DR on FV. It means leverage is detrimental to a firm's value while the firm has higher profitability. Therefore, it is inferred that leverage does not bring benefits to add value to a firm's valuation. It can be concluded from the results that the interest tax shield grows as the debt ratio rises, but the costs associated with leverage rise as well, counteracting the beneficial impacts of DR on FV. It is generally assumed that DR adds value to the firm traditional capital structure theory of Modigliani and Miller (1963). However, it is not always accurate as exhibited by the empirical results. It might be due to the incurred cost of leverage. Hence, the advanced BFO theory is found supportive. The current study substantially contributes to the existing literature through its novel evidence and approach. The current findings bring noticeable implications to all concerned stakeholders, including

managers and investors, to look at leverage critically and carefully before involving it in capital structure. It should be noted by the managers that the inclusion of leverage should not have a higher cost which hinders the firm's valuation. Policymakers need to understand the limits of leverage inclusion in capital structuring so that it should benefit firms rather harm it.

This study cannot be separated from its limitations. First, the study talks only about non-financial firms listed in India. The financial firms are excluded due to their different approaches to reporting information and work culture. Therefore, the current study can be extended in a separate study of financial firms. In addition, the study's scope is limited to the Indian economy. The results cannot be taken in general. However, the findings give enough impetus to other emerging economies of a similar kind, such as China and Russia. This study can be conducted further on financial firms. The sample can be broadened to have cross-country evidence. Other parameters for a firm's valuation can be incorporated in future studies on capital management. The moderation of competition and inflation for the association of DR and the firm's value should also be examined in future studies.

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Appendix A

Table A1. Industry-wise distribution of sample firms.

Sl. No.	Sector	Firms Count
1	Automobile	12
2	Technology	5
3	Textiles	1
4	Cons Durable	3
5	Construction	7
6	Energy	10
7	Engineering	2
8	FMCG	9
9	Healthcare	10
10	Metals	4
11	Services	6
12	Chemicals	5
13	Communication	2
	Total	76

Notes: The sample's industry classification corresponds to the data from India's Bombay Stock Exchange (BSE). The sample is diverse in that it includes firms from 13 different industries.

Appendix B Additional Robustness Check

It was discussed earlier that the results' robustness is an essential approach to ensure the reliability of obtained empirical evidence. It is observed from the literature that quantile regression itself is an approach which ensures the results' robustness, as it estimates results in different quantiles. However, this study follows a multimodel approach using different proxies of the main dependent variable (firm's value). The two most important proxies of a firm's value (i.e., lasset and local) are taken for the study's main analysis. In addition, in this section, we take two more proxies to further ensure the results' robustness. The five other proxies of firm's valuation are "Tobin's Q" (TQ), "market-to-book ratio" MTB,

"enterprise value" (ENTV), ROA ("return on assets"), and ROE ("return on equity"). The applicability of these variables for the models is checked as being non-normal (see Table 3).

TQ is one of the firm's valuation indicators. It is computed by dividing the firm's market value by the firm's asset replacement cost (Zhao and Murrell 2016; Vo 2017). Similarly, MTB is another valuation indicator computed as dividing the market value of a firm's equity by the book value of the same equity (Zhao and Murrell 2016; Vo 2017). ENTV is calculated by the sum of the market cap and net debt (Hao et al. 2022; Ronald and Semuel 2022). ROA and ROE are other valuation proxies indicating return on assets and return on equity, respectively (Hao et al. 2022; Ronald and Semuel 2022).

Tables A2 and A3 present the regression outcomes of base models and interaction models, respectively, using TQ and MTB as the dependent variables. In Table A1, DR significantly impacts both TQ and MTB in the quantiles. However, DR relates to TQ negatively in all cases. DR connects to MTB negatively in the lower quantile (10%ile) and positively in the higher quantiles (50%ile and 90%ile). In Table A2, the explanatory variable of interest is the interaction term (i_DR_NPM). It is found to be significant and positive with TQ only in the lower quantile (10%ile) at 5% significance. In rest of the cases, interaction term is insignificant. Comparing the results with the outcomes of main analysis, very similar results are obtained, indicating that DR negatively affects a firm's value. However, in the higher quantile, it has positive connectivity to the firm's value in some cases. Thus, it further confirms the results' robustness.

In Tables A4 and A5, the regression outcomes of the base models and the interaction models having ENTV ('enterprise value'), ROA, and ROE are demonstrated. DR in almost all cases (quantiles) is found to be significant for ENTV, ROA, and ROE. Here, again, in Table A4, the DR is negatively connected to ENTV in all quantiles. DR is negatively connected to ROA in the lower quantile (10%ile); however, it is found to be positively associated with ROA in the higher quantiles ((50%ile and 90%ile). In the case of ROE (as the dependent variable), DR is found to be positively related to it. In Table A5 for interaction models, the interaction trem 'i_DR_NPM' is found to be insignificant in all quantiles for ENTV. In case of ROA, 'i_DR_NPM' is also insignificant in all quantiles. The interaction term 'i_DR_NPM' is found to be significant and positive in the lower quantile (10%ile) in the case of ROE only. The interaction term 'i_DR_NPM' is insignificant in all other models in Table A5. Here, again, very similar outcomes are obtained using other proxies of firm's valuation (i.e., ENTV, ROA, and ROE).

Table A2. Results of quantile regressions (with base variable).

		TQ			MTB		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−1.084 *	0.278	0.000	−0.487 ***	0.258	0.059
	lsales	0.004	0.039	0.909	−0.179 *	0.050	0.000
	lpbit	−0.068	0.056	0.227	0.027	0.052	0.598
	ROA	0.543 *	0.172	0.001	1.098 *	0.160	0.000
Quantile (50)	DR	−0.729 *	0.212	0.000	1.867 *	0.310	0.000
	lsales	−0.154 *	0.028	0.000	−0.006	0.064	0.914
	lpbit	−0.248 *	0.043	0.000	−0.915 *	0.105	0.000
	ROA	2.148 *	0.150	0.000	3.357 *	0.209	0.000
Quantile (90)	DR	−2.264 **	0.950	0.017	1.113 *	0.379	0.005
	lsales	−0.076	0.144	0.595	0.388	0.306	0.205
	lpbit	−0.445 **	0.207	0.031	−1.879 *	0.385	0.000
	ROA	4.468 *	0.494	0.000	8.456 *	0.972	0.000

Note: *, **, and *** are for *p*-value is significant at 1%, 5%, and 10%.

Table A3. Results of quantile regressions (with interaction variable).

		TQ			MTB		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−1.010 *	0.291	0.000	−0.123	0.739	0.867
	NPM	−0.524	0.728	0.472	0.007	0.295	0.978
	i_DR_NPM	1.196 **	0.566	0.034	−0.892	1.821	0.624
	lsales	−0.177	0.223	0.427	−0.299 ***	0.172	0.082
	lpbit	0.106	0.240	0.658	0.134	0.166	0.420
	ROA	0.923 *	0.136	0.000	1.103 *	0.189	0.000
Quantile (50)	DR	−0.552	0.349	0.114	2.376 *	0.735	0.001
	NPM	−0.212	0.364	0.561	−0.200	0.700	0.774
	i_DR_NPM	−0.117	0.786	0.881	−1.013	1.388	0.465
	lsales	−0.226 *	0.059	0.000	−0.246	0.218	0.259
	lpbit	−0.183 *	0.060	0.002	−0.698 *	0.223	0.001
	ROA	2.202 *	0.144	0.000	3.502 *	0.269	0.000
Quantile (90)	DR	−2.562 **	1.199	0.033	0.381	3.072	0.901
	NPM	−0.442	1.388	0.750	−0.652	2.251	0.772
	i_DR_NPM	1.120	3.087	0.716	2.841	6.055	0.638
	lsales	−0.143	0.267	0.592	0.266	0.778	0.732
	lpbit	−0.400	0.281	0.155	−1.742 **	0.792	0.028
	ROA	4.465 *	0.454	0.000	8.467 *	0.873	0.000

Note: *, **, and *** are for *p*-value being significant at 1%, 5%, and 10%.

Table A4. Results of quantile regressions (with base variable).

		ENTV			ROA			ROE		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−0.639 **	0.303	0.035	−0.937 *	0.135	0.000	3.498 **	1.399	0.012
	lsales	0.002	0.048	0.958	−0.223 *	0.026	0.000	1.724 *	0.292	0.000
	lpbit	0.867 *	0.052	0.000	0.260 *	0.024	0.000	−1.738 *	0.289	0.000
	opmar	1.085 *	0.413	0.008	−0.998 *	0.224	0.000	3.180 *	0.371	0.000
Quantile (50)	DR	−0.379 *	0.139	0.006	1.713 *	0.098	0.000	12.610 *	0.942	0.000
	lsales	−0.019	0.015	0.193	−0.321 *	0.027	0.000	1.136 *	0.208	0.000
	lpbit	0.715 *	0.020	0.000	0.311 *	0.028	0.000	−1.466 *	0.224	0.000
	opmar	0.708 *	0.147	0.000	−0.497 *	0.156	0.001	7.017 *	0.425	0.000
Quantile (90)	DR	0.787 *	0.214	0.000	1.474 *	0.402	0.000	20.766 *	3.343	0.000
	lsales	0.070 *	0.020	0.000	−0.784 *	0.092	0.000	1.206 **	0.608	0.047
	lpbit	0.570 *	0.030	0.000	0.792 *	0.097	0.000	−2.448 *	0.752	0.001
	opmar	0.727 *	0.199	0.000	−2.051 **	0.843	0.015	4.323 *	1.388	0.000

Note: *, **, and *** are for *p*-value being significant at 1%, 5%, and 10%.

Table A5. Results of quantile regressions (with interaction variable).

		ENTV			ROA			ROE		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	**p**	**Coef.**	**Std. Err.**	***p***
Quantile (10)	DR	−0.190	0.448	0.670	−0.741 ***	0.398	0.063	−3.681 *	1.267	0.003
	NPM	−0.033	0.132	0.803	0.074	0.090	0.409	−0.966 **	0.419	0.021
	i_DR_NPM	−0.823	1.204	0.494	−0.655	1.565	0.675	7.833 *	1.861	0.000
	lsales	−0.209	0.147	0.156	−0.192 *	0.072	0.008	1.421	0.254	0.000
	lpbit	1.055 *	0.145	0.000	0.226 *	0.070	0.001	−1.414	0.264	0.000
	opmar	0.722	0.846	0.393	−0.574	0.594	0.334	13.842	0.240	0.000

Table A5. *Cont.*

		ENTV			ROA			ROE		
		Coef.	**Std. Err.**	***p***	**Coef.**	**Std. Err.**	**p**	**Coef.**	**Std. Err.**	***p***
Quantile (50)	DR	0.538 ***	0.303	0.076	1.228 *	0.242	0.000	11.100 *	1.674	0.000
	NPM	0.001	0.009	0.878	0.059	0.117	0.609	−0.485	1.023	0.635
	i_DR_NPM	−0.590	0.688	0.391	−1.499	0.923	0.105	8.752	5.431	0.107
	lsales	−0.018	0.055	0.734	−0.297 *	0.072	0.000	1.551	0.412	0.000
	lpbit	0.708 *	0.053	0.000	0.267 *	0.072	0.000	−1.845	0.392	0.000
	opmar	1.093 *	0.322	0.000	0.287	0.473	0.543	17.540	0.400	0.000
Quantile (90)	DR	0.758 **	0.363	0.036	1.712 *	0.596	0.004	17.006 *	4.271	0.000
	NPM	1.016 *	0.215	0.000	0.065	0.722	0.927	−1.135	4.262	0.790
	i_DR_NPM	−0.721	0.526	0.170	−1.091	2.257	0.628	11.056	11.939	0.354
	lsales	0.192 ***	0.111	0.084	−0.550 ***	0.321	0.087	1.761	1.218	0.148
	lpbit	0.445 *	0.106	0.000	0.528	0.321	0.101	−2.816	1.273	0.027
	opmar	1.908 *	0.323	0.000	−0.329	1.360	0.808	24.420	1.202	0.000

Note: *, **, and *** are for *p*-value being significant at 1%, 5%, and 10%.

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Does Sustainable Finance Work on Banking Sector in ASEAN?: The Effect of Sustainable Finance and Capital on Firm Value with Institutional Ownership as a Moderating Variable

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Abstract: Management in the banking industry is not solely focused on financial performance but also on the sustainability of their portfolios. To achieve this, banks need to incorporate sustainable finance into their balance sheet. In addition, a global phenomenon has emerged where investors have demanded the inclusion of sustainable finance in portfolios. This financial instrument served to support the global agreement on climate change, which they were committed to making a reality. The impact of sustainable finance on firm value remains a question. Therefore, this study aimed to examine the effect of sustainable finance and capital on firm value within the banking industry, focusing on entities listed on the ASEAN stock market from 2015 to 2021. To assess investor demand for involvement in sustainable finance, a moderating variable was included in the model. Furthermore, this study used a quantitative design and a purposive sampling technique with panel data regression analysis for the hypothesis testing. The results showed that sustainable finance and capital had a significant effect on firm value. Institutional ownership moderated the relationship between sustainable finance and firm value, although it did not moderate the link between capital and firm value. This indicated that banks prioritized sustainable finance due to its positive impact on their operations, ultimately leading to an improvement in firm value. Furthermore, institutional ownership influenced the relationship between sustainable finance and firm value, as banks strived to comply with international society or enhance firm value. This study incorporated profitability ratios and firm size as the control variables.

Keywords: sustainable finance; firm's value; institutional ownership

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1. Introduction

The current state of climate change is a threat to various aspects that impact global life, spanning economic, social, and environmental realms. In this context, a milestone achieved by the international community, which significantly influenced efforts to mitigate climate change, was the Kyoto Protocol (1998). This protocol is in accordance with the principles of the United Nations Framework on Climate Change, which urged industrialized countries and transitioning world economic actors to reduce greenhouse emissions according to their individual commitments and targets.

After the Kyoto Protocol, the Paris Agreement (2015) emerged as a significant successor. This agreement holds international recognition in addressing climate change. Fundamentally, the Paris Agreement commits its participants to restrain the increase in global average temperature to well below 2 °C above pre-industrial levels, with a striving ambition to cap the increase at 1.5 °C. The agreement took effect and became binding on 4 November 2016.

Malaysian Sustainable Finance Initiative (2020) noted that Several ASEAN Member States (AMS) have taken part in several international efforts relating to sustainable finance on a regional level. This displays a desire to advance the growth of sustainable finance in accordance with global standards. The Task Force on Climate-related Financial Disclosures

(TCFD) is a group of organizations that includes the Securities Commission of Malaysia (SC), Bursa Malaysia, the Monetary Authority of Singapore, and Singapore Exchange Limited. The group's goal is to develop voluntary, standardized disclosures for companies to use regarding climate-related financial risk. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS), which has the goal of enhancing the role of the financial system to better manage risks and mobilize capital for green and low-carbon investments, includes central banks from the four AMS: Indonesia, Malaysia, Singapore, and Thailand.

In relation to the global climate change initiative, Indonesia has introduced regulatory policies through its Financial Service Authority (OJK) in 2015. The Sustainability Finance Roadmap Phase I (2015–2019) was established as a framework incorporating sustainable finance goals and principles, along with a comprehensive work plan. Subsequently, the Sustainable Finance Roadmap Phase II (2021–2025) outlines distinct categories within sustainable finance, offers intricate details in its development, and expounds on matters pertaining to climate change. As a form of commitment from the Indonesian government, the Financial Services Authority (OJK) enacted Regulation No. 51/POJK/03/2017 in 2017. This regulation governs the Implementation of Sustainable Finance for Financial Institutions, Issuers, and Public Companies.

In the meanwhile, in 2020, the Monetary Authority of Singapore (MAS) developed a framework named the Green Finance Action Plan (2020). This finance framework aims to support a sustainable Singapore and facilitate Asia's transition to support a sustainable future. Furthermore, it aims to (1) strengthen financial sector resilience to environmental risk; (2) develop markets and solutions for a sustainable economy; (3) harness technology to enable trusted and efficient sustainable financial flows; (4) build knowledge and capabilities in sustainable finance. In 2017, the Securities Commission of Malaysia (SC) issued the Guideline on Sustainable and Responsible Investment Fund (2017) to facilitate and encourage the growth of SRI funds in Malaysia. Moreover, the SRI Guidelines is a five-year roadmap that encompasses five overarching strategies, known as the 5i-Strategy. The strategies aim to (1) broaden the selection of SRI instruments, expanding the SRI investor base; (2) establish a strong SRI issuer base; (3) instill a robust internal governance culture; (4) design information architecture in the SRI ecosystem.

These initiatives from ASEAN financial authorities showed a huge commitment to developing sustainable activities. These activities must be supported by dedicated financial instruments to finance the development of sustainability activities. The financial instrument to finance these is so-called sustainable finance or green credit. Nandy and Lodh (2012) explained that green credit is a type of financial product that emerged from sustainable or environmental financing, focusing on environmental protection and sustainable development of the financial sector. Twidell and Cabot (2003) described the following two functions of sustainable finance. One is to offer advisory and financial support for sustainable business ventures. It offers investment advisory services to clients on sustainable projects by designing sustainable financing policies. Second, the bank employs a variety of loan-placement strategies from the market's perspective, market development, and regulation to stimulate sustainable development. This is achieved by utilizing its information advantages. Therefore, sustainable projects supported by green credit or sustainable instruments would result in success in sustainable activities.

Sustainable activities take the form of reports issued by financial institutions, issuers, and public or private companies that voluntarily disclose sustainable information. Some authors (Berthelot et al. 2012) affirmed that sustainable reports included a range of information regarding past, present, and future corporate activities linked to environmental and social matters, alongside the financial implications stemming from management decisions and environment-related endeavors. Others (Manisa et al. 2017) also asserted that sustainability reporting embodied the accountability of a firm to consumers, employees, shareholders, communities, and the environment across all aspects of its operations.

For banks, sustainability reports play a crucial role in disclosing their business activities involving economic, social, and environmental aspects. According to the International Monetary Fund (IMF), the primary role of banking is to receive and allocate public funds for financing individuals in need. Among the sustainability activities reported by banks, sustainable financing holds a prominent place.

Sustainable finance constitutes a sustainable product or service with sustainable performance. Some authors (Xi et al. 2021) showed that State-Owned Banks (SOEs) in China were the main agents in the implementation of this form of finance. This reflected its essential role in national economic development from the perspective of the government. In Indonesia, sustainable finance is comprehensively supported by the financial services sector to foster economic growth while harmonizing economic, social, and environmental interests, as stipulated in OJK Regulation No. 51.

Drawing on signaling theory, it is proposed that firms engaging in sustainable activities are more likely to garner recognition from investors, resulting in higher valuations in the capital market (Swarnapali 2020).

An investigation on the relationship between sustainable performance, firm value, and the role of green innovation (Chouaibi et al. 2020) ascertained a significant positive relationship between the level of green innovation intensity within sustainable-performing firms and their financial performance. According to (Chouaibi et al. 2020), a superior level of green innovation intensity can facilitate better access to financial resources and higher firm value.

Another significant green activity within banking is sustainable finance; Xi et al. (2021) explained that several firms prioritized a green economy in the event of environmental constraints. This event traces back to 1974 when The Federal Republic of Germany established the Ecological Bank. Subsequently, a group of banks and financial institutions, including IFC, ABN, and Amro, introduced The Equator Principles in 2002. The topic has consistently been on the agenda at G20 conferences up to the most recent one in 2022. Describing green credit as a financial instrument stemming from environmental financing of sustainable finance, Nandy and Lodh (2012) emphasized its role in promoting sustainable development by focusing on environmental protection. This instrument has gained substantial traction in Asian financial markets. In addition, (Lin 2022) reported that sustainable funds available to Asian investors experienced steady inflows throughout 2021, amassing a total of USD 16 billion in new assets and contributing to an aggregate size of sustainable investment products of around USD 14.4 trillion. Regarding the index, (Lin 2022) noted that the Asia ex-Japan ESG index consistently outperformed the broad-based regional index by an average of 1.59% annually between 2017 and 2021. The Morningstar Asia Pacific Index demonstrated the most significant outperformance in 2021, surpassing its non-ESG equivalent by 1.74%.

Green credit is not solely confined to project financing but also includes activities that comply with environment (E), social (S), and governance (G) aspects. It specifically necessitates adherence to environmental and ecological activities that prevent nature from project-related harm. Despite its substantial environmental focus, (Xi et al. 2021) asserted that green credit was not only about environmental protection but was also related to the economic benefits of the banks. This consequently broadens the terminology of sustainable financing since it entails not only green instruments but also ESG activities and the economic value of projects. This concept has transcended globally, spreading from Europe to the ASEAN region. In ASEAN countries, where fossil fuel consumption is particularly higher and environmental risks are more pronounced compared to other developed nations, studies in this field are intriguing. Banks, as the main source of funds, are at the center of the economy, distributing funds to these firms. This disbursement is facilitated through instruments like the Sustainable Linked Loan (SLL). According to the Loan Syndication and Trading Association (2023), the SLL includes various loan instruments and contingent facilities (such as bonding lines, guarantees, or letters of credit) that provide incentives for borrowers to achieve ambitious, predetermined sustainability performance objectives. Moreover, borrowers implementing this instrument are required to meet sustainability

performance targets, track the performance, and provide corresponding reports. Banks typically disclose information about this instrument in their sustainability reports or other separate regular publications. Meanwhile, capital market instruments such as green and sustainable bonds have primary choices, and the SLL market has rapidly grown to over USD 332 billion (Bloomberg). Sustainalytics in 2021 explained that ING and Philips were among the first to issue this instrument, and these loans now aim to bolster sustainability development within corporate entities by linking loan terms to overall sustainability performance. In the ASEAN markets, the issuance of these instruments has reached a total of USD 12.8 billion. This comprised Indonesia (USD 5.5 billion), Singapore (USD 11.9 billion), Malaysia (2.6 billion), the Philippines (USD 4.9 billion), Myanmar (USD 44 million), Thailand (USD 3.86 billion), and Vietnam (USD 484 million) (CBI 2020). Despite the spread of COVID-19 to ASEAN countries, sustainable finance instruments performed strongly in 2020, with Singapore taking the lead, followed by other countries.

Reports related to sustainable finance can be accessed through sustainable reports that adhere to the Global Reporting Initiative (GRI 201-1, GRI 201-3). In addition to sustainable financing, an important component in assessing banking sustainability is capital. The capital structure of the banks is one of the sources of funds where sustainable finance can be disbursed. It is a very highly regulated component by the financial authority or central banks where the banks are operated. Banking capital is disclosed within the Annual Report. The capital adequacy ratio is presented in the form of the Capital Adequacy Ratio (CAR), which (Brastama and Yadnya 2020) emphasized as the ability of the bank to mitigate risks stemming from losses in order to support operational activities. Fordian (2017) established that the CAR influenced banking stock prices, while (Khan et al. 2020) demonstrated its influence on banking profitability. This prompted a significant interest in re-examining the effect of the CAR on firm value.

The current study introduced a model to examine whether institutional ownership could strengthen or weaken the impact of sustainable financing on firm value. Institutional ownership was incorporated into the model as a moderating variable. In agency theory, institutional ownership represents a principal entity that influences the decisions made by agents or management. Consequently, it is perceived as a potential influencer, and the inclusion as a moderating variable was drawn from the work of (Velte 2020), who analyzed the relationship between sustainable and financial performance by incorporating CEO power as a moderator. The study indicated a positive correlation between both variables, particularly in the presence of the CEO power index.

Previous studies on sustainability products and services have predominantly focused on industries within the technology and energy sectors. In the banking sector, sustainable products such as sustainable finance are relatively new. Therefore, its inclusion as one of the independent variables was a novelty in this study, particularly when examining its correlation with firm value. There is also a significant need to investigate the influence of the variable on firm value, a topic that has not been previously explored.

This study aimed to investigate the impact of sustainable finance and capital on firm value within the ASEAN banking sector. The moderating effect of institutional ownership was assessed in the relationship between sustainable finance, capital, and firm value. The following are the objectives of this study:

- Analyze the impact of sustainable finance and capital on firm value;
- Evaluate the effect of institutional ownership on the relationship between sustainable finance, capital, and firm value.

This study employed both base and interaction models. The base model primarily examined the relationship between sustainable finance, capital, and firm value. On the other hand, the interaction model evaluated the same relationship by introducing institutional ownership as a moderator.

The results provided valuable benefits to both stakeholders and investors. From a stakeholder perspective, this study offered insights into the implementation of sustainable finance in the banking of ASEAN markets. Meanwhile, for investors, the results indi-

cated the impact of including banks with sustainable finance in portfolios and how their capital influenced investment decisions. The results demonstrated the significant role of institutional ownership in the relationship between variables.

The subsequent sections are organized as follows: Section 2 comprises the literature review and hypothesis development, Section 3 covers the research methodology and data, Section 4 presents the results, Section 5 explains the discussion, and Section 6 outlines the conclusion.

2. Literature Review and Hypothesis Development

The literature review of this paper was categorized into four parts: the first was related to the impact of sustainable finance on firm value; the second was associated with the issue of bank capital adequacy on firm value; the third was related to the influence of institutional ownership on the relationship between sustainable finance and bank capital adequacy on firm value; the forth covered the control variables.

2.1. Sustainable Finance on Firm Value

One of the significant milestones in promoting green finance was the Paris Agreement of 2015. According to (Desalegn et al. 2022), the adoption of the agreement marked the inception of growing interest in green finance. Sutherland (2020) defined this form of finance as a mechanism involving various financial institutions, both public and private, along with diverse asset categories such as green bonds, loans, funds, and others. All these instruments needed to adhere to environmentally friendly principles. Some authors (Xi et al. 2021), in addressing the relevant concepts within green finance, emphasize that environmental finance is a specific instrument intended to support environmental quality and manage environmental risk (White and Labatt 2002). Conversely, sustainable finance is a type of financial instrument that integrates considerations of environmental, social, and governance factors into investment decisions (Xi et al. 2021). This approach emphasizes long-term focus, directing more funding and investment toward sustainability-oriented projects and activities. Other studies related to sustainable finance, including the work of Xi et al. (2021), underscored its crucial role in advancing the objectives of the European Green Deal, with the aim of supporting green initiatives. Some authors (Desalegn et al. 2022) mentioned that the requirement of financing will range from USD 1.6 to 3.8 trillion annually until 2050. Addressing the gap to achieve sustainability goals, an estimated USD 2.5 trillion per year is needed (Monasterolo 2020). This gap can be potentially bridged through green instruments such as green loans, credits, and bonds. In the context of green bonds (Zenno and Aruga 2022) reported an increasing trend in green bond issuances since 2016. The study showed a greenium level of 0.47% in China, indicating its attractiveness within the financial market. The term "greenium" refers to the yield difference between green and conventional bonds (Zenno and Aruga 2022). However, (Deschryver and Mariz 2020) observed that the green bond market was exceeding demand and encountering a supply–demand imbalance. Some authors (Ehlers and Packer 2017) investigated the concept of greenium with green bond certificates in global capital markets, while (Lebelle et al. 2020) examined the market reactions to announcements of green bonds in various markets.

Investigations on green credit or sustainable finance remain relatively limited. Central banks, as regulators, are required to establish regulations pertaining to green credit in order to stimulate the adoption of this instrument. Some authors (Khudyakova and Urumov 2021) recommended that central banks and other non-bank financial regulators play a significant role in building foundational regulations supporting green finance. Other authors (Criscuolo and Menon 2015) asserted that the development of green financing required a continuous approach within the financial and monetary framework. This approach should enable environmental solutions through global solidarity and democratic economic governance to promote green financing.

Several studies utilized green credit as a proxy for financial instruments promoting sustainable development goals and environmental protection. These studies consistently

found a positive correlation between green credit and financial performance. Moreover, engagement in green credit activities fosters a favorable reputation for banks within the market. Sustainable finance is an integral aspect of ESG activities for firms that are typically listed in sustainability reports. One author (Buallay 2019) emphasized that sustainability reporting provided a contemporary perspective on developing future value related to business policies. Other authors (Melinda and Wardhani 2020) also discovered a significant correlation between the ESG performance of firms in the Asia region and firm value. This indicated that firms with stronger ESG tended to possess higher corporate value. Moreover, sustainable finance could contribute to the green innovation of the financial sector.

Caracuel and Ortiz de Mandojana (2013) demonstrated that green innovation had a correlation with firm financial performance. Sustainable finance is intrinsically linked to the sustainable performance of firms. Alareeni and Hamdan (2020) investigated the impact of sustainable performance on the financial market performance (Tobin Q) of firms listed on the US S&P 500. Their study showed that disclosure of sustainable performance as a whole, along with its individual components, positively affected enterprise market performance. Consequently, higher disclosure of sustainable performance led to better assessment by investors. Some authors (Chouaibi et al. 2020) found that sustainable performance had a positive influence on firm market performance, as proxied by Tobin Q. This further indicated that strong, sustainable performance enhanced firm value, and the subcomponent, including environmental, social, and governance aspects, positively affected firm value.

Studies relating sustainable finance to firm value in academic literature are limited. The current study employed an interaction model as a moderating variable. Institutional ownership played a significant role in this relationship, as it greatly influenced the firm direction in managing sustainable finance within the corporation. One author (Velte 2020), in investigating a similar topic, revealed the impact of sustainable performance on financial performance, with CEO power as a moderating variable. The results showed that the positive relationship between both variables was more prominent with the CEO power index. A strong CEO on the management board (considered to have a better influence on performance and (non) financial disclosure) could also strengthen the relationship. Sustainable financing was based on the annual report or sustainability reporting of the bank, which followed the GRI (Global Reporting Initiative) or other international reporting standards. Sustainable financing in this study was in the form of a financial portfolio, measured by comparing the amount of credit disbursed for business activities with the total credited by the bank. With regard to the above, the following hypothesis was formulated:

H1. *Sustainable financing has an impact on firm value.*

2.2. Bank Capital Adequacy Ratio on Firm Value

Several studies have examined the drivers of bank profitability, with (Oino 2017) specifically identifying two approaches for their exploration, namely the Structure–Conduct–Performance paradigm (SCP) and Persistence of Profit (POP). The SCP approach assumes that profitability is determined by market structural features such as concentration, the economics of scale, and entry and exit barriers (Slater and Olson 2002). POP, on the other hand, focuses on the time series behavior of profitability, suggesting that any temporary deviation of firm profitability from the market average quickly adjusts through entry and exit effects (John et al. 2004). Both approaches show entry and exit as key drivers of profitability. In the banking sector, there is a substantial barrier for both determinants due to the minimum capital and regulatory requirements of the company (Oino 2017), significantly affecting firm performance.

Petty and Gutherie (2020), investigating bank intellectual capital, identified it as one of the approaches for assessing and measuring intangible assets. Some other studies demonstrated that intellectual capital plays a crucial role in increasing firm values. Its effective management can enable firms to enhance financial performance (Khalique et al. 2015; Chowdhury et al. 2019). In terms of financial capital or the capital structure of banks,

Fraisse et al. (2017) posited that the BASEL II regulatory framework caused capital requirements to differ across banks and firms. Banks that increased the capital requirement ratio by 1 percentage point experienced a 10 percentage point reduction in lending (Fraisse et al. 2017). This indicated that when banks raise capital and regulatory requirements, they become susceptible to decreasing lending portfolios, impacting their performance negatively. In relation to firm value, specifically within the banking sector, capital is a key determinant of success in enhancing value. The Capital Adequacy Ratio (CAR) is employed by banking regulators to maintain an adequate level and assess the stability of the banking system against potential losses in bank management (Nazneen and Aspal 2014). Fordian (2017) discovered that the CAR influenced the price of banking stocks, while (Khan et al. 2020) demonstrated its impact on banking profitability. Moreover, (Mendy et al. 2023), investigating economic policy, capital adequacy, and profitability, found that banks could mitigate the impact of policy uncertainty on their economic performance and operations.

Capital, involving both financial and intellectual aspects, is a regulatory concern for regulators, as it holds significant systemic implications for the financial system. In the banking industry, this concept is captured by the term "capital adequacy ratio," a result of restructuring the existing capital structure to enhance resilience against widespread distress (Chioma et al. 2021). Regulators set minimum capital requirements to ensure banks can withstand financial distress. Sari et al. (2018) discovered that tier-1 capital had a negative impact on profitability while having no effect on firm performance. This indicated that banks maintaining and increasing tier-1 capital could limit loan portfolio expansion, subsequently impacting firm performance. These results signified that the market valued banks with strong capital structures to handle financial crises, as evident by high capital adequacy ratios or minimum capital requirements. Therefore, banks should continually review capital adequacy ratios to strengthen their capital structures for resilience during crises and in accordance with current economic conditions as prescribed by regulatory authorities (Chioma et al. 2021).

Studies have revealed that apart from enhancing bank performance, capital plays a crucial role in maintaining bank stability, particularly during crises. Some authors (Yakubu and Bunyaminu 2021), during the 2007–2009 crisis, revealed a positively significant impact of capital requirements on bank stability. However, the study showed that the effect of capital on stability was conditional under the current institutional quality. It also concluded that the stringent implementation of capital regulations was essential to ensure a healthy and stable banking sector in Sub-Saharan Africa. There was a crucial need to explore this variable in the ASEAN banking market, particularly among those engaging in sustainable finance rooted in environmental, social, and governance activities requiring substantial capital. The second hypothesis was formulated as follows.

H2. *CAR has an impact on firm value.*

2.3. Moderate Effect of Institutional Ownership of Sustainable Finance and Capital on Firm Value

Shareholders play a significant role in guiding management to achieve the vision and mission of the firm through the general annual meeting. After the Paris Agreement in 2015, shareholders directed the focus of management toward fulfilling commitments to combat climate change. To exert influence, shareholders require power during the annual meeting. Institutional ownership wields strong voting power to guide management in adhering to the commitments of the Paris Agreement. One author (Velte 2020), investigating a related domain, analyzed the impact of sustainable performance on financial performance by incorporating CEO power as a moderator. The results showed that the positive relationship between sustainable and financial performance was more prominent with a higher CEO power index. Moreover, a strong CEO within the management board (possessing greater influence on performance and (non)financial disclosure) enhanced the relationship between both variables.

Some authors (Mallorquí and Santana-Martín 2010) showed a direct and negative relationship between institutional ownership and firm value. Similarly, (Zhao et al. 2022) demonstrated that temporary institutional ownership tended to hinder green innovation within firms. This effect extended to financial and social benefits, often serving as a means to mitigate short-term risks. Internal shareholders and managers had a significant effect on sustainable performance (McCahery et al. 2016). Sustainable and responsible investment (SRI) has historically evolved into a mainstream investing strategy. Recent studies examined the relationship between institutional ownership and corporate sustainable performance, revealing two opposing views of the relationship. Although institutional ownership can improve firm performance by monitoring motivation, it can also cause a hindrance due to myopia motivations, particularly in terms of ESG corporate performance (Jia et al. 2022).

An area of existing literature that uses agency theory to examine the connection between institutional ownership and sustainable or ESG performance comes to conflicting conclusions. Investigating whether institutional ownership enhances sustainable finance and other sustainable components, such as capital structure, is crucial, particularly in the banking sector (Jia et al. 2022). Furthermore, the study mentioned that institutional ownership exhibited a strong ability to gather information and effectively monitor corporate governance, influencing decision making through members' resources and expertise. Therefore, the following hypotheses were formulated:

H3. *Institutional ownership moderates the effect of sustainable finance on firm value.*

H4. *Institutional ownership moderates the effect of capital adequacy on firm value.*

2.4. Conceptual Framework

The following conceptual framework was developed to illustrate our study. In constructing this framework, firm value was adopted as the dependent variable. The initial independent variable employed was sustainable finance (SR), which measured the quantity of the finance in a bank portfolio. The Capital Adequacy Ratio (CAR) was the second independent variable, while institutional ownership served a moderating role. The three variables of profitability, employed ROE (Return on Equity), ROA (Return on Assets), and banking size, were used to re-examine their impact on firm value. Below Figure 1 is the model which visually represents the concept.

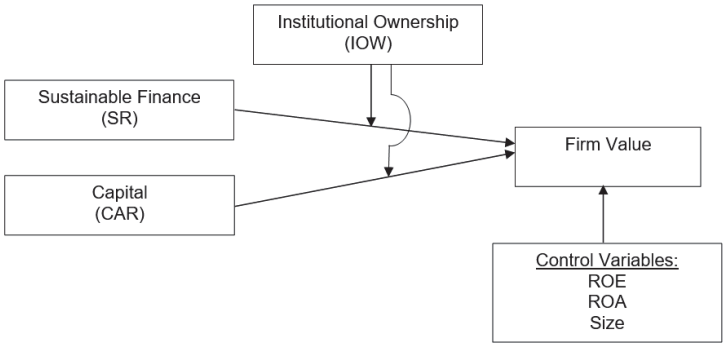

Figure 1. Conceptual framework. Source: Constructed by the authors.

3. Materials and Methods

3.1. Data

This study was based on secondary data collected during the period 2015–2021. The selected timeframe was of particular interest due to a significant event, namely the COVID-19 outbreak. The analysis employed secondary data, comprising financial data sourced from financial and audited sustainability reports published by firms, as well as stock prices extracted from Yahoo Finance database. The financial and sustainability reports were

accessed through stock exchange and other relevant platforms. A concise description of each variable of concern is presented in Table 1 below.

Table 1. List of variables.

SN	Variables	Type	Code	Definition	Cititations
1	Firm Value	DV	FV	Market value of the company's assets divided by replacement cost of the company's assets (Tobin's Q)	(Fiakas 2005)
2	Sustainable Finance	IV	SF	Credit disbursed for sustainable business activities divided by the total credit disbursed by the bank	(GRI n.d.)
3	Institutional Ownership	IV	IOW	Percentage of institutional ownership	(Siew et al. 2016)
4	SFXIOW	MV	SFXIOW	-	
5	CAR	IV	CAR	The capital (Tier 1,2) of the bank divided by risk-weighted assets	(Basel Committee on Banking Regulation 2011)
6	CARXIOW	MV	CARXIOW	-	
7	ROE	CV	ROE	Net income divided by total equity	(Ross et al. 2016)
8	ROA	CV	ROA	Net income divided by total assets	(Ross et al. 2016)
9	SIZE	CV	SIZE	Log of firm size	(Melinda and Wardhani 2020)

Source: constructed by the authors.

3.2. Methods/Methodology

This study adopted an explanatory approach through a quantitative method. A non-probability sampling approach was employed, and purposive sampling was specifically used to gather relevant data samples. Purposive sampling entails the deliberate selection of sampling units within a population segment with the most pertinent information on the characteristics of interest (Guarte and Barrios 2006). The secondary data collected from the period 2015–2021 served as the basis for this study.

Based on predetermined selection criteria, a balanced panel data set was compiled for 12 banks spanning the years 2015–2021 (Table 2). These commercial banks were situated in Indonesia, Malaysia, the Philippines, Singapore, and Thailand (Table 3). The finalized sample size that met the criteria for seven consecutive years was 84. The data subsequently underwent panel and assumption classic tests before being subjected to regression analysis. Data processing and calculations were conducted on the sample using Microsoft Excel and Eviews 10.

Table 2. Selection of study samples.

No.	Criteria of Sample	Total
1	Banks listed on the stock exchange in ASEAN countries in the period 2015–2021.	121
2	Banks with no consistent sustainability score from the Bloomberg website in the period 2015–2021.	−87
3	Banks with no sustainable green financing in the period 2015–2021.	−22
	Total sample (Perusahaan)	12
	Total sample (years)	7
	Total sample (12 × 7)	84

Source: constructed by the authors.

Data selection

Table 3. Company list data selection.

No	Code	Bank Name	Country
1	BNI	PT. Bank Negara Indonesia Tbk	Indonesia
2	BCA	PT. Bank Central Asia Tbk	Indonesia
3	BRI	PT. Bank Rakyat Indonesia Tbk	Indonesia
4	BMRI	PT. Bank Mandiri Tbk	Indonesia
5	BDMN	PT. Bank Danamon Indonesia Tbk	Indonesia
6	CIMB	CIMB Group Holdings	Malaysia
7	BDO	BDO Unibank Inc	Philippines
8	BPI	Bank of The Philippines Islands	Philippines
9	PNB	Philippines National Bank	Philippines
10	DBS	DBS Group Holdings	Singapore
11	BAY	Bank Ayudhya	Thailand
12	KBANK	Kasikorn Bank	Thailand

Source: constructed by the authors.

3.3. Model Specification

A panel data model (PDM) was used to facilitate the analysis conducted. Panel data analysis possesses attributes of both cross-sectional and time-series (Baltagi 2008). PDM offers a broader dataset for investigation compared to other cross-sectional or time-series analyses (Agarwal et al. 2023).

The model specifications are presented as follows:

Model 1.

$$\boldsymbol{FV = \alpha + \beta_1 SF_{it} + \beta_2 SF * IOW_{it} + \beta_3 ROE_{it} + \beta_4 ROA + \beta_5 Size + \varepsilon}$$

Model 2.

$$\boldsymbol{FV = \alpha + \beta_1\ CAR_{it} + \beta_2 CAR * IOW_t + \beta_3 ROE_{it} + \beta_4 ROA + \beta_5 Size + \varepsilon}$$

where $\boldsymbol{FV}$ denotes fair value and is a dependent variable, and $\boldsymbol{\alpha}$ represents constant term. $\boldsymbol{SF}$ denotes sustainable finance, and $\boldsymbol{CAR}$ stands for capital adequacy ratio, both of which are independent variables. $\boldsymbol{SF * IOW}$ and $\boldsymbol{CAR * IOW_t}$ represent the interaction term, where $\boldsymbol{IOW}$ as institutional ownership is considered a moderating variable. The other terms in this model include $\boldsymbol{ROE}$, $\boldsymbol{ROA}$, and Size as control variables. Lastly, $\boldsymbol{\varepsilon}$ is denoted as an error term.

4. Results

4.1. Descriptive Analysis and Correlation

Descriptive statistics and correlational values of the variables applied in the study are presented in Tables 4 and 5, respectively. FV had an average value of 104.28 and a standard deviation of 16.52. The mean value of SF was 9.93, accompanied by a standard deviation of 13.82, indicating relatively low expenditures on sustainable financing aspects. The mean value of IOW was 71.12, with a standard deviation of 17.94, indicating a high institutional ownership composition within each bank. SFXIOW had a mean and standard deviation of 6.65 and 8.95, respectively.

Table 4. Descriptive statistics.

Variables	Mean	Standard Deviation	Min	Max
FV	104.28	16.52	87.75	168.61
SF	9.93	13.82	0	65.1
IOW	71.12	17.94	43.2	97.33
SFXIOW	6.65	8.95	0	36.26
CAR	18.34	3.48	12.4	26.7
CARXIOW	13	3.92	6.84	24.69
ROE	10.76	4.27	1.21	22.66
ROA	1.47	0.71	0.2	3.13
SIZE	3056	317	2684	3508

Note: Mean, standard deviation, minimum and maximum value.

Table 5. Correlation matrix table.

Variables	FV	SF	SFXIOW	CAR	CARXIOW	ROE	ROA	SIZE
FV	1							
SF	0.272	1						
SFXIO	0.182	0.958	1					
CAR	0.589	0.397	0.391	1				
CARXIO	0.031	0.092	0.243	0.533	1			
ROE	0.59	0.046	−0.005	0.259	−0.14	1		
ROA	0.749	0.186	0.135	0.563	−0.003	0.759	1	
SIZE	0.599	0.504	0.517	0.754	0.261	0.45	0.687	1

Note: 0.05 represents a significant correlation coefficient.

A mean value of 18.34 was recorded for CAR, accompanied by a standard deviation of 3.48. CARXIOW had a mean and standard deviation of 13.00 and 12.40, respectively.

In the correlation matrix, significant correlations were indicated by values below 0.80. Multicollinearity was addressed within all significant variable pairs.

Table 6 shows that all the variables have values lower than 0.10, indicating the absence of multicollinearity issues. The correlation matrix revealed crucial relationships between the main variables.

Table 6. Variance in the inflation factor value.

Variable	VIF	Variable	VIF
SF	1.097	CAR	1.009
SFXIO	1.212	CARXIO	1.334
ROE	4.228	ROE	4.394
ROA	4.152	ROA	4.197

4.2. Normality Test

Figures 2 and 3, respectively, show probability values of 0.42 and 0.15, both exceeding 0.5. This suggested the data distribution was normal.

4.3. Heteroskedasticity Test

Tables 7 and 8 show the results of tests conducted, revealing significance values of >0.05 for all variables. This indicated the regression model no longer contains symptoms of heteroskedasticity.

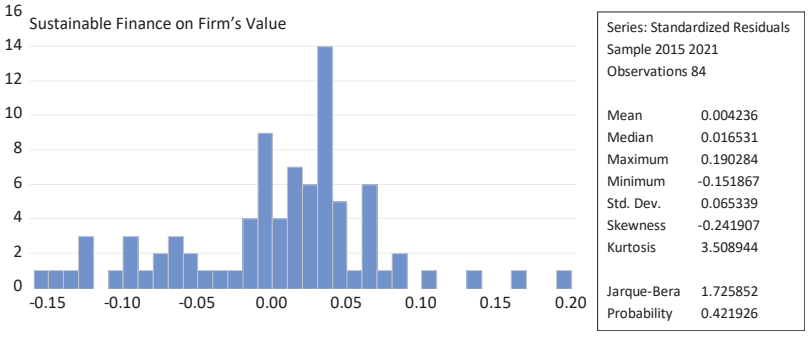

Figure 2. Normality test of the effect of sustainable finance on firm value.

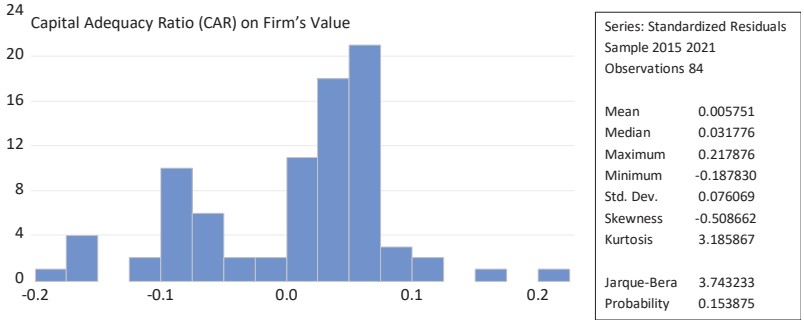

Figure 3. Normality test of the effect of Capital Adequacy Ratio (CAR) on firm value.

Table 7. Heteroscedasticity test results of sustainable finance and firm value using institutional ownership as a moderating variable.

Variable	Coefficient	*p* Value
C	−5.588838	0.439
SF	0.001718	0.9857
SFXIOW	−0.11373	0.4357
ROE	0.147344	0.5336
ROA	−1.64465	0.3264
SIZE	0.003795	0.1505

Note: represent at 0.05 a significant correlation coefficient.

Table 8. Heteroscedasticity test results comparing CAR and firm value using institutional ownership as a moderating variable.

Variable	Coefficient	*p* Value
C	−1.319057	0.9014
CAR	−0.046124	0.925
CARXIOW	−0.230766	0.2658
ROE	−0.263343	0.4439
ROA	−0.751682	0.802
SIZE	0.005413	0.1777

Note: 0.05 represents a significant correlation coefficient.

4.4. Estimation Selection Test

The estimation selection tests were conducted using the Chow and Hausman tests (Yaffee 2003). Both tests for independent variables yielded a probability value of 0.000. This indicated that the Fixed Effect Model was the most appropriate for this study.

4.5. Regression (Result of Models 1 and 2)

Regression analysis of panel data includes a structure known as panel data. Typically, parameter estimation in regression analysis with cross-sectional data is achieved using the Ordinary Least Square (OLS) method. The result of estimation is referred to as the Best Linear Unbiased Estimation (BLUE) in panel data regression. After conducting classical assumption tests, the obtained results indicated normal data distribution, absence of autocorrelation, multicollinearity, and heteroscedasticity symptoms.

The relationship between FV (dependent variable) and SF (explanatory variable) was examined in model 1, as shown in Table 8. Both Chow and Hausman tests were conducted to determine the most suitable estimation test. These tests yielded significant results with values less than 0.05, indicating compatibility with the fixed effect model.

Table 9 shows that the R2-adjusted value was 0.73 or 73%. This indicated the independent variable could explain 73% of the variance in the dependent variable, while the remaining 27% was accounted for by variables beyond the scope of this study. The Prob (F-statistic) test showed a value of 0.000, which was <0.5 (5%), indicating the independent variables collectively had a significant impact on the dependent variable. This confirmed the feasibility of the study model for testing hypotheses. The t test revealed that sustainable financing exhibited a positive coefficient value and a probability value of 0.000, indicating its significance at the 5% level. This was in accordance with (Chouaibi et al. 2020), demonstrating that a higher level of green innovation intensity led to improved access to financial resources and enhanced market performance. Therefore, sustainable finance was one of the most proactive approaches for boosting firm value, signifying the acceptance of H1. SFXIOW showed a negative coefficient and a probability value of 0.0000. This indicated that institutional ownership moderated the effect of sustainable financing on firm value, in line with (Calza et al. 2016) and (Velte 2020), signifying the acceptance of H3. Institutional ownership weakened the effect of sustainable finance on firm value.

Table 9. Regression results of sustainable finance and firm value using institutional ownership as a moderating variable.

Variable	Coefficient	*p* Value
C	46.93172	0.0001
SF	0.671225	0.0000 **
SFXIOW	−0.991779	0.0000 **
ROE	−0.566035	0.0089 **
ROA	14.18658	0.0000 **
SIZE	0.013899	0.0008 **
N	84	
R^2 Adjusted	0.738804	
Prob(F-statistic)	0.0000	

Note: 0.05 represents a significant correlation coefficient ($p < 0.05$) **.

Table 10 shows that the R2-adjusted value was 0.72 or 72%. This indicated that the independent variable could explain 72% of the variance of the dependent variable, with the remaining 28% being accounted for by variables beyond the scope of this study. The Prob (F-statistic) test yielded a value of 0.0000, which was <0.5 (5%), confirming the independent variables collectively influenced the dependent variable. These results underscored the feasibility of the study model for testing the hypothesis. The t test revealed that the CAR exhibited a positive coefficient and a probability value of 0.000, indicating its significance at the 5% level. These results were in line with (Nazneen and Aspal 2014), (Fordian 2017), (Khan et al. 2020), and (Brastama and Yadnya 2020), collectively proving that the Capital Adequacy Ratio (CAR) was employed by regulatory bodies to ensure banks maintained adequate capital levels. This was also carried out to assess the soundness of the banking system against potential losses, signifying the acceptance of H2. CARXIOW, on the other hand, showed a probability value of 0.3482, suggesting

institutional ownership did not moderate the effect of the Capital Adequacy Ratio on firm value. While this was not supported by (Guo and Platikanov 2019), it was in line with (Raharjo and Muhyasrsyah 2021), resulting in the rejection of H4. The control variables ROE, ROA, and SIZE showed probabilities of <5%, indicating their effect on firm value.

Table 10. Regression results of CAR and firm value using institutional ownership as a moderating variable.

Variable	Coefficient	*p* Value
C	46.57976	0.0001
CAR	1.170024	0.0028 **
CARXIOW	−0.275292	0.3482
ROE	−0.421481	0.0911
ROA	12.85669	0.0000 **
SIZE	0.008318	0.0469 **
N	84	
R^2 Adjusted	0.721139	
Prob(F-statistic)	0.0000	

Note: 0.05 represents a significant correlation coefficient ($p < 0.05$) **.

4.6. Robustness of the Results

The Wald test was conducted to examine endogeneity in the study. The test yielded significant *p*-values of 0.000 (<0.05). Therefore, the robustness of the results of both models was confirmed, as the tests showed that the null hypothesis of no endogeneity was not rejected.

5. Discussion

The main goal of this study was to assess the implementation of sustainable finance and capital structure to firm value in the banking sector in the ASEAN region. The banking sector, as a financial intermediary, will take the lead in disbursing sustainable finance, whereas this supports sustainable activities in all sectors. Banking aims to implement sustainable finance in alliance with the stakeholder objectives and in compliance with the government's framework principles. Sustainable finance leads to a sustainable portfolio in the long run. Furthermore, the banks that lend credit in this instrument engage in ESG activities in their operation; hence, it improves their image in the market. On the other hand, to be able to finance sustainable financial instruments, banks need to have ample capital. Capital, known as capital regulation, is one of the main financial parameters of the banks, and it is important to manage. It is therefore necessary for management to understand the effect of sustainable finance and capital on firm value.

This study's finding supported the first hypothesis (H1), confirming sustainable finance significantly influenced firm value. It also implied that banks with sustainable finance in their portfolio had an impact on firm value. This could be attributed to the bank's emphasis on both financial and sustainable performance based on ESG principles. Banks were better positioned for long-term sustainability, leading to improved asset value and increased demand for their stocks in the market, ultimately influencing firm value.

The preceding research supporting this study was Lai et al. (2022), which showed that green credit significantly improved new energy companies' economic benefits. Moreover, their study suggested that this impact can last over the long term. The study findings by Chouaibi et al. (2020) also support our findings. These authors explored the relationship between sustainable performance, firm value, and the role of green innovation and identified a significant positive relationship between the intensity of green innovation in firms and both sustainable and financial performance. These results were further supported by (Melinda and Wardhani 2020), who investigated the impact of sustainable activities, proxied by the ESG proxy score, on firm value.

This study indicated that a higher proportion of sustainable finance within a bank portfolio elicited positive responses from investors, leading to an increased firm value. This was in line with signal theory (Spence 1973), wherein firms transmitting positive signals, such as sustainable finance, to investors prompted them to respond by purchasing shares. This action could boost the market and firm values.

Banks in each ASEAN country engaged in sustainable finance practices as part of their commitment to the Paris Agreement (2015), with the aim of reducing global warming by 2 °C. Encouraged by these commitments, banks offered sustainable finance to debtors, guided by principles that were in accordance with environmental, social, and good governance. This underscored the focus of the bank on sustainable finance, contributing to its ongoing operational sustainability and enhanced firm value.

The acceptance of the second hypothesis (H2) demonstrated that the Capital Adequacy Ratio (CAR) significantly influenced firm value. In the banking sector, capital serves as a fundamental source of funding, dictating both financial stability and performance. The proxy for bank capital, the CAR, determines the capacity of the bank in relation to risk assets and current liabilities. A higher CAR signifies stronger financial stability, subsequently impacting firm value. Investors tend to react positively when the CAR surpasses the regulatory threshold, as this indicates the ability of the bank to expand its credit portfolio and withstand risk-weighted assets.

This study was in line with (Nazneen and Aspal 2014), Fordian (2017), (Khan et al. 2020), and Brastama and Yadnya (2020), collectively demonstrating that the CAR was used by banking regulators to establish capital adequacy levels and assess the robustness of the banking system against potential losses in management.

The results were also consistent with banking policies positively implementing capital adequacy in accordance with BASEL III. According to these guidelines, banks were required to maintain a minimum CAR of 8%. This ratio, measuring bank capital in relation to risk-weighted assets, aimed to bolster strong capitalization and enhance the financial resilience of banks worldwide, enabling them to withstand economic and financial shocks, such as the global recession of 2008. A well-capitalized bank is more capable of enduring episodes of financial stress in the broader economy (Basel Committee on Banking Regulation 2011). As a result, banks with robust capital adequacy tend to elicit positive responses from investors. This phenomenon also aligned with the principles of signal theory (Spence 1973), where investors reacted to indications of strong banking capital by increasing the firm value.

The third hypothesis (H3) was supported by the results, as institutional ownership strengthened the relationship between sustainable finance and firm value. This could be attributed to the institutional ownership recognizing the benefit of incorporating sustainable finance in the credit portfolio. As a result, they influenced bank management to increase the proportion of sustainable finance. Several benefits underscored the support of institutional ownership: *Firstly*, it enhanced both financial and operational performance, ensuring long-term sustainability. *Secondly*, it was in accordance with the global agreement to combat climate change and reduce global warming by 2 °C, enhancing the reputation of the bank in the market. *Thirdly*, it complied with the government's regulatory framework focused on sustainability, avoiding potential administration fines. *Fourthly*, it improved the ESG performance of the bank. Finally, by combining these benefits, demand for the bank's shares in the capital market increased, augmenting the firm value.

This study was in line with (Alipour 2013), demonstrating the influence of institutional ownership on firm value. The rationale behind the third hypothesis, where institutional ownership weakened the effect of sustainable finance on firm value, lay in the higher costs associated with distributing sustainable finance compared to commercial finance. Consequently, institutional investors might display less interest in sustainable finance, prompting them to encourage firms to reduce allocation toward this form of finance.

The fourth hypothesis (H4), however, had been rejected, as the results indicated institutional ownership did not enhance the relationship between the CAR and firm value. This signified that the regulation and oversight of capital adequacy was primarily the

responsibility of regulators and central banks. Therefore, institutional ownership might not exert additional influence on bank management, since it is already highly regulated. Regulatory bodies and central banks were well-equipped to monitor and enforce the capital adequacy threshold, alerting the management to take action when their capital fell below the mandated minimum. This regulatory aspect served as both a standard practice for bank operations and a direct key performance indicator. Consequently, institutional ownership might not play a significant moderating role in the relationship between capital and firm value.

According to BASEL III guidelines, the minimum threshold for bank capital was 8%. Should a bank fail to meet this requirement, it was mandated to secure additional capital from its owner. As such, there was little resistance from owners to contribute capital as it was a compulsory condition under BASEL III. In cases where the existing owner lacked the necessary funds, the bank might need new owners/investors to inject capital, potentially reducing the portion of existing ownership. These results were not in line with the results of (Brastama and Yadnya 2020), which established a relationship between CAR and firm value, with financial performance acting as a mediator.

The results from the tested control variables, namely ROA, ROE, and SIZE, showed their significance and impact on firm value. This could be attributed to ROA and ROE reflecting the profitability performance of the bank, where better ROA and ROE values corresponded to increased firm value. The significance of SIZE on firm value could be attributed to the fact that a larger bank size led to higher financial performance and the interest income generated from the larger asset base.

6. Conclusions

In conclusion, this study aimed to investigate the effects of sustainable finance and the Capital Adequacy Ratio (CAR) on firm value in banks listed on the stock exchange in ASEAN for the period 2015–2021. Meanwhile, there have been limited studies in the field of sustainable finance and its impact on firm value; the implementation of sustainable finance has gained prominence in response to the Paris Agreement (2015), emphasizing the commitment of global stakeholders to climate change and various environmental (E), Social (S), and Governance (G) activities. Sustainable finance, in line with this commitment, played a crucial role in achieving targets such as keeping the global temperature rise below 2^0 above its pre-industrial level and even striving for a maximum 1.5 °C increase. Fulfilling these goals required substantial investment in sustainable finance, while investors also demanded profitability in their investments. Consequently, the value of firms was significantly influenced by their engagement in sustainable finance. In order to facilitate disbursement toward this form of finance, management needed to have ample capital on their balance sheet. This resulted in a delicate balance for management as they navigated the dual challenge of fostering sustainable finance and maintaining an optimal capital structure, with corporate performance feeling the impact (Khan et al. 2020). Investors, guided by sustainable principles, played a crucial role in guiding firms toward managing sustainable finance and capital allocation effectively.

The following conclusions were drawn from this study: (1) Sustainable finance significantly affected firm value, indicating the acceptance of the first hypothesis, which was consistent with (Chouaibi et al. 2020). (2) The Capital Adequacy Ratio (CAR) affected firm value, indicating the acceptance of the second hypothesis, which was in line with (Nazneen and Aspal 2014), (Fordian 2017), (Khan et al. 2020), and (Brastama and Yadnya 2020). (3) Institutional ownership moderated the relationship between sustainable finance and firm value, signifying acceptance of the third hypothesis, which was consistent with (Calza et al. 2016) and (Velte 2020), (4) Institutional ownership did not moderate the effect of the Capital Adequacy Ratio (CAR) on firm value, leading to the rejection of the fourth hypothesis, which was not in line with (Guo and Platikanov 2019), but consistent with (Raharjo and Muhyasrsyah 2021). (5) Control variables ROE, ROA, and SIZE all affected firm value.

This study aimed to bridge the knowledge gap by comprehensively understanding the implementation of sustainable finance in the balance sheet of a bank and its impact on firm value. Recognizing that banks required capital to finance their operations necessitated its exploration in enhancing firm value. The results hold great importance as they contribute to the existing literature. This study was further enriched by adopting an interaction model, incorporating institutional ownership as a moderator. Moreover, it offers valuable insights to management, emphasizing the dual imperatives of increasing sustainable finance in the portfolio to augment firm value while also effectively managing capital requirements to facilitate sustainable finance and comply with regulatory standards to increase value. This study contributes novel knowledge concerning the preference for institutional ownership. These results show that investors were keen on imploring management to increase sustainable finance practices, recognizing its potential to elevate firm value. These insights were particularly valuable for fund managers, as they could consider reprofiling portfolios from conventional to sustainable in composition. While this study delved into essential aspects, some limitations are still acknowledged, necessitating the recommendation of future investigations to include more data periods.

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Examining the Impact of Agency Issues on Corporate Performance: A Bibliometric Analysis

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Abstract: An agency problem is defined as a conflict of interest arising due to a misalignment of interests among the managers and other stakeholders of the company. This article aims to review the articles addressing the agency problem and their impact on business performance. This article reviews the contributions of prominent theorists on agency problems and agency costs. Using bibliometric attributes of 740 articles from the Scopus database, this study highlights the publishing trend and outlets, along with leading contributors and collaborators in terms of authors, institutions, and countries. This study identifies the clusters through the bibliographic coupling technique and a trend topics analysis. Most researchers have focused on corporate governance and expressed the agency problem as one of the impact areas. This study is unique as no study to date specifically focuses solely on agency theory or the agency problem through the lens of bibliometric analysis. Future research directions on agency problems and their solutions conclude this study.

Keywords: agency problem; agency cost; agency theory; bibliometric; business performance; corporate governance

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1. Introduction

The principal–agent problem (or the agency dilemma) occurs when one entity (the "agent") is employed to make decisions and/or take actions on behalf of, or impacts, another entity (the "principal"). The dilemma happens when agents act in their best interests, contrary to principals' interests. This problem usually arises when both entities maximize their interests. When agents focus on their own gains before the principal's gains, it is called an agency problem (AP). The emergence of agency theory and the associated problems is rooted in the complexities arising from the separation of ownership and control within organizations. Originating in the 1970s, agency theory became a pivotal framework employed across diverse disciplines such as economics, law, finance, accounting, and political science. Initially introduced by Jensen and Meckling (1976), the theory gained traction due to its applicability in analyzing the challenges arising when one entity, the agent, acts on behalf of another entity, the principal, often leading to misalignments of interests. Ownership separation from control in big companies leads to a conflict of interests among shareholders and management. The firm's managers often focus on personal goals that conflict with the shareholders' wealth maximization objective (Shaifali 2019). The issues that arise among principals and their agents are often due to a lack of congruence in their approach because of information asymmetry (Jiang 2023). Information asymmetry

happens when either party has more information than the other. Thus, the main focus of both principals and agents should be on resolving APs and saving on agency costs. Panda and Leepsa (2017) define agency costs as the internal costs arising from the misalignment of interests of the agent and the principal. It constitutes the cost of selecting and recruiting a suitable agent, costs incurred in setting benchmarks, overlooking the agent's actions, the bonding costs, and the residual loss arising from conflicts between the management and shareholders. Scholars researching Agency Theory (AT) study the relationship between principals and agents, and suggest ways to minimize the occurrences of agency issues and, ultimately, agency costs.

The principal and agent theory emerged in the 1970s from the combined economics and institutional theory disciplines. The theory was taken up by researchers in several disciplines, like strategy (Barnard 1938), law (Banfield 1985), economics and finance (Jensen and Meckling 1976), accounting (Baiman 1990), and political science (Mitnick 1982), among many. Researchers use agency theory to analyze the top leaders in big private and public enterprises. Given its roots in economics, agency theory suggests that the agents who work in an organization have a utility maximization logic and seek to get what is in their best interest, even when it is not in the best interest of the organization (Eisenhardt 1989). Based on the essential contributions of the work of Barnard (1938) on cooperation in organizations, agency theory focuses on the conflict between objectives, created by various individuals who, while engaged in these organizations, seek what is in their best interest.

The number of bibliometric studies on AP is limited (Bendickson et al. 2016). Past studies have focused a lot on corporate governance (Jahja et al. 2020; Naciti et al. 2022), boards of directors (Pascual-Fuster and Crespí-Cladera 2018), or more specific topics, such as board diversity and its impact on CSR (Baker et al. 2020a; Do 2023; Eliwa et al. 2023). This study differs from other published reviews because, to the best of the authors' knowledge, this research is the first bibliometric study that focuses primarily on the agency problem (AP) and its impact on financial performance across business fields with language, scholarly, and subject filtration in the Scopus database. This review focuses on mapping the domain of AP research through a bibliometric analysis. The insights on the current scenario and future research directions are shared after different analyses on AP. Thus, this study has the below-mentioned Research Questions (RQs):

- What is the trend in publications on AP?
- Which are the most influential publishing outlets for research on AP?
- Who are the prolific contributors to the field of AP?
- What are the themes and clusters for research on AP?
- What are the future research areas in the field of AP?

The remaining sections of this document are arranged as follows. The second section discusses the background of AP. The third section describes the methodology applied for this study. Results and discussions for all analyses are summarized in the fourth section. Further sections contain the research themes and future research directions to strengthen the field of AP.

2. Theoretical Background

Though the problem of the agency has existed for a very long time, Smith was the first author to ever write about it (Seth 2018). He forecasted that if the management of an organization is handed over to a person or a group of persons other than the owners, then it is likely that they may not work for the benefit of the owners. Bhabra and Wood (2014) discussed the ownership structure of large firms operating in the USA and argued that agents may use the assets of the organization to maximize their interests. The roots of agency theory trace back to seminal works that have shaped its conceptual foundation. Berle and Means' groundbreaking work in 1932, particularly in "The Modern Corporation and Private Property", laid the groundwork for understanding the challenges arising from the separation of ownership and control in large corporations. Moving forward, Eisenhardt's influential theories significantly advanced the discourse by addressing the intricacies

of control mechanisms within organizations (Eisenhardt 1985, 1989). These milestones underscore the theoretical evolution of agency theory, emphasizing shifts in focus from corporate governance dynamics to nuanced examinations of principal–agent relationships. Furthermore, pivotal contributions by scholars such as Jensen and Meckling in their 1976 paper, "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure", have been instrumental in defining the theoretical landscape of agency issues.

Jensen and Meckling (1976) discussed three types of agency costs—monitoring costs, bonding costs, and residual losses. Monitoring costs are incurred by the principal to oversee the conduct and limit the aberrant activities of its agent. Bonding expenses are incurred to ensure that agents do not make certain decisions that may impact the principal's interests. The residual losses arise due to the misalignment of interests of the principal and the agent and are measured in terms of the dollar equivalent of the losses to the principal. Often the agents tend to underdeliver on their promises to the principal to maximize their gains. This is referred to as a 'moral hazard'. Also, the more autonomy an agent gets to conduct complex work, the more significant the moral hazard becomes (Cowden et al. 2020). As per theorists, there are two main reasons behind principal–agent problems—one arising out of different risk preferences of the principals and the agents, and another arising since both the principals and agents are rational human beings and work towards maximization of their self-interests. Managers may misbehave if their interests differ from those of the company (Dalton et al. 2007).

Panda and Leepsa (2017) segregated the AP into three types. The first type occurs amongst the principal and agents, due to the different levels of risk appetite, information asymmetry, and self-satisfying behavior based on the rational behavior of human beings (Elfenbein and Knott 2015), which states that rational individuals maximize their interests. This misalignment in interests of agents and the principals gives rise to the principal–agent problem. The second type of AP happens between the major and minor shareholders in a company. Shareholders with major holdings have a higher weight in voting and are likely to make decisions for their benefit which may obstruct the interests of shareholders with a lesser stake in the company. This problem is usually found in companies with higher ownership proportion gaps (Fama and Jensen 1983). The third type of problem arises because of risk preferences between the principals and creditors of the company. Quite often, projects are funded with more debt and less equity, as financing completely through equity is expensive (Jiraporn et al. 2012; Khandelwal et al. 2023; Narayan et al. 2021). Some projects are subject to a high risk of default. If such a project is successful, good premiums are enjoyed by the shareholders, and creditors are paid at a pre-decided rate of interest; however, if the project is unsuccessful, the creditors are asked to accept partial settlements due to loss in projects. This problem is seen in companies engaging in project financing. This leads to creditors being stuck with lesser returns for high risks.

3. Review Methodology

3.1. Search Strategy

The search strategy for this review meticulously employed a three-step process to ensure the inclusion of relevant articles while adhering to specific criteria. The first step involved a database search, primarily focusing on the Scopus database due to its comprehensive coverage and reliable bibliometric parameters (Archambault et al. 2009; Kumar et al. 2021; Mongeon and Paul-Hus 2016). The search targeted articles related to agency theory using the keywords "agency cost" and "agency problem" with the 'OR' operator, forming the foundational elements of agency theory. To narrow down the focus, additional keywords like "performance*" and "profit*" were included with the Boolean operator '*' to capture all keywords starting with "profit" (Tripathi et al. 2023). The study specifically concentrated on articles related to 'business', 'organization', or 'firm'. Exclusion criteria were then applied, excluding articles from 2022 and limiting the search horizon to 2021. The second step involved subject filtration, considering only articles within the "Business, Management, and Accounting" category in the Scopus database, aligning with the overarching

discipline where agency theory resides. The third and final step incorporated scholarly filtration, restricting the review to research articles published in English, thereby excluding other languages and publication types such as conference proceedings, reviews, books, and book chapters (Mukherjee et al. 2022). Through this comprehensive inclusion and exclusion criteria framework, the study ultimately reviewed a total of 740 documents, ensuring a focused and relevant dataset for analysis.

3.2. Bibliometric Analysis

Bibliometric analysis serves as an invaluable methodological tool in scrutinizing the state of research within complex domains such as AP (Naciti et al. 2022). Its utility lies in its ability to systematically evaluate and quantify the existing body of literature, offering insights into the trends, contributors, and thematic clusters shaping the field (Mukherjee et al. 2022). By employing bibliometric analysis, this study navigates the expansive landscape of AP research, unraveling patterns that might be challenging to discern through traditional literature reviews. This study applied a comprehensive bibliometric analysis to examine 740 selected publications on AP. Extracting bibliometric data from the Scopus database, an array of analyses explored the landscape of AP research. The investigation covered publication years, authors, journal titles, citations, institutes, and countries, addressing specific research questions. The study aimed to discern evolving publishing trends (RQ1), identify prominent outlets in the field (RQ2), and highlight top-performing authors, institutions, and countries (RQ3). The bibliometric analysis also delved into keyword exploration through co-occurrence analysis, forming knowledge clusters that delineate sub-themes within the AP domain (RQ4). Inspired by Donthu et al. (2021), this approach assessed the impact and centrality of each knowledge cluster. Within these clusters, articles were scrutinized to ascertain current research topics (RQ5) and identify gaps in the existing literature, shaping the future research agenda.

To implement the bibliometric analysis, the study utilized the bibliometrix package in the R software (version 4.3.1) environment, facilitated by the RStudio platform. Specifically, the 'Biblioshiny' command harnessed bibliometric techniques, including the identification of top authors, sources, and articles, as well as the analysis of countries, institutions, and trending keywords. Additionally, science mapping was employed to visually represent knowledge clusters, providing a comprehensive overview of interconnections and focal points within the AP research landscape. Through this multifaceted approach, the study aims to contribute a nuanced understanding of the current state and future directions of research on AP and its implications for corporate performance.

4. Results and Discussion

The study highlights that the earliest articles on AP were published in 1985, and the total research articles indexed in Scopus till 2021 stand at 740 after the language, scholarly, and subject filtration. This section further contains detailed findings on the bibliometric attributes of the articles under study. Firstly, the line chart represents the year-wise publications corresponding to the year of publication (Figure 1). Secondly, the top publishing outlets are listed in order of decreasing total citations (Table 1, Figure 2).

Table 1. Top Performing Publishing Outlets in the Research Domain of Agency Theory.

Publishing Outlet	h-Index	TC	NP	PY-Start
Strategic Management Journal	17	2681	19	1991
Academy Of Management Journal	13	2676	13	1996
Journal Of Financial Economics	9	1600	9	1995
Management Science	8	1503	10	1985
Journal Of Management	11	1353	12	2001
Journal Of Accounting And Economics	8	1087	10	1987
Journal Of Corporate Finance	14	1079	19	1996
Corporate Governance: An International Review	14	756	24	1994

Table 1. *Cont.*

Publishing Outlet	h-Index	TC	NP	PY-Start
Accounting Review	5	698	7	1997
Journal Of Finance	3	583	3	2004
Journal Of Business Ethics	11	527	16	1991
Journal Of International Business Studies	2	483	2	2004
Journal Of Business Research	5	413	5	2005
The Journal Of Finance	1	377	1	1993
Academy Of Management Review	1	369	1	2005
Review Of Finance	3	340	3	2011
Journal Of Financial And Quantitative Analysis	3	328	3	1987
Review Of Financial Studies	3	310	3	2012
Marketing Science	8	302	8	1997
Harvard Law Review	1	300	1	2004

Note: Articles are Ranked based on total citations received, TC—Total Citations, NP—Number of Publications, PY-Start—Publication Year Start.

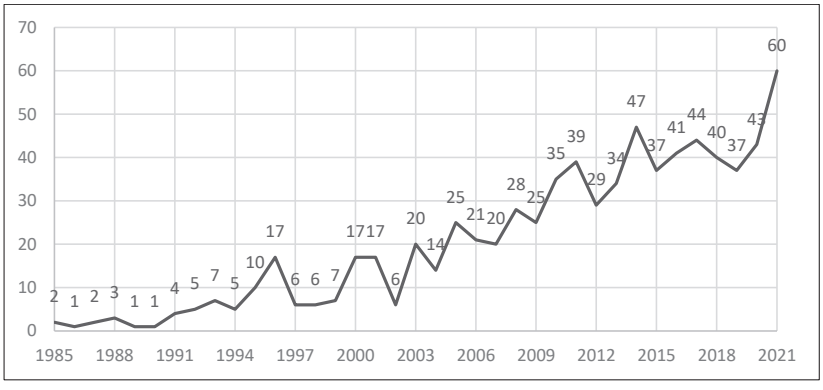

Figure 1. Publishing Trend of Research on Agency Theory.

Figure 2. Leading Publishing Outlets of Research on Agency Theory (Minimum of Six Articles).

4.1. Publishing Trend

The line plot depicts the published articles of each year following the search strategy. As evident from Figure 3, it is evident that AP has seen increased scholarly participation over the previous 36 years. The highest number of articles were published in 2021 (n = 60), being the most recent year of the study. A sharp growth is observed from 2002 with increased outputs each year hence.

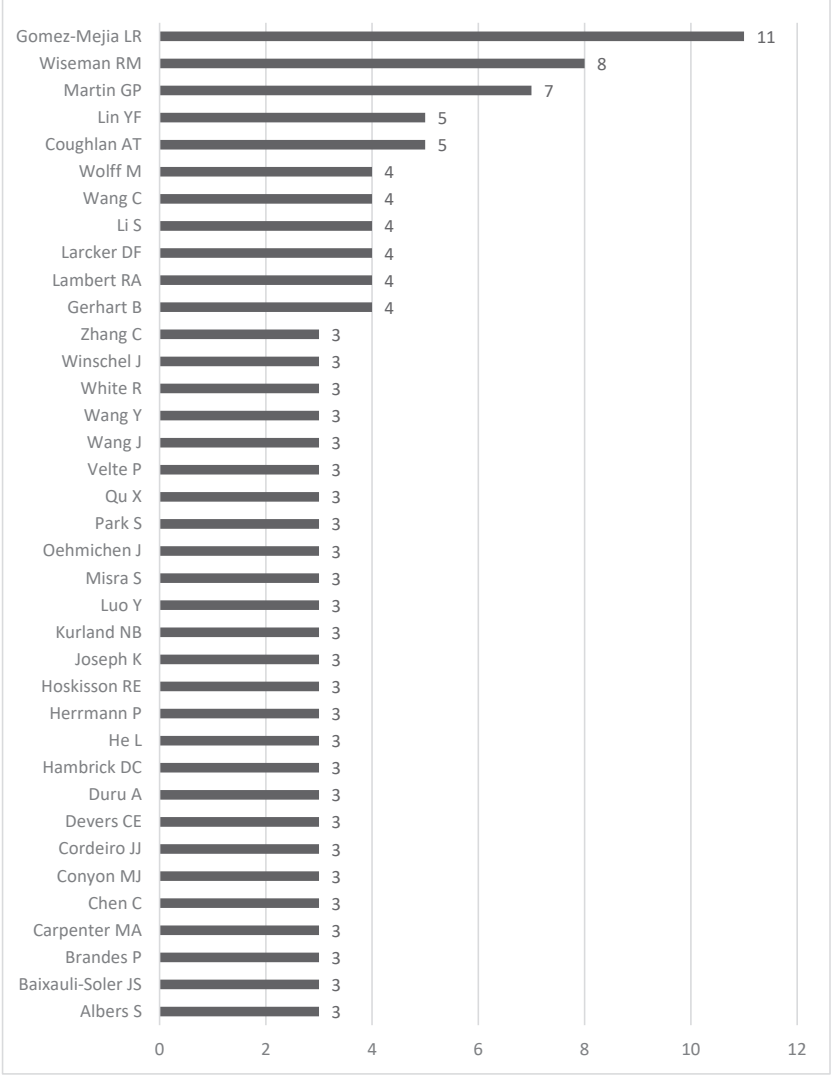

Figure 3. Leading Authors Contributing to Research on Agency Theory (Minimum of Three Research Articles).

4.2. Publishing Outlets

The analysis of documents by publishing outlets reveals the top journals publishing articles on AP. This study lists the top 20 journals, sorted in order of total citations on articles, in Table 1. The journals are listed with their corresponding h-index, total citations on articles on AP, the number of publications, and the publication year start.

The study puts the 'Strategic Management Journal' by Wiley at the first rank based on total citations. Interestingly, the 'Strategic Management Journal' is also the best journal based on its h-index for the study. This is followed by 'Academy of Management Journal' by the Academy of Management, and 'The Journal of Financial Economics' by Elsevier. Figure 4 depicts the top 20 publishing outlets based on the number of papers contributed to the existing literature on AP. The 'Corporate Governance: An International Review' is the highest contributor in this field, followed by the 'Journal of Corporate Finance' and 'Strategic Management Journal', respectively.

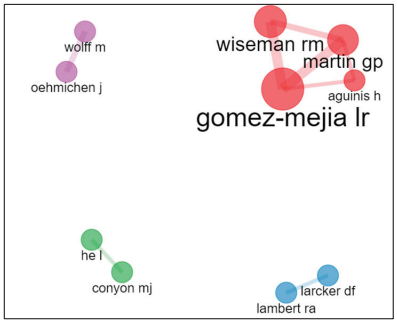

Figure 4. Prominent Collaborators (Authors) on the Research Topic of Agency Theory.

4.3. Publication Performance

4.3.1. Global Citations

Global citations refer to the count of all articles globally that have cited the study without any filtration (e.g., language, scholarly, subject, etc.) (Baker et al. 2020b). Table 2 summarizes the articles on AP in decreasing order of their total global citations. In this study, we find that the article with the most global citations is "Control: Organizational and Economic Approaches", published in 1985 in the journal "Management Science". It is cited a total of 1227 times globally, and is followed by the article titled "Internationalization and firm governance: The roles of CEO compensation, top team composition, and board structure", published in 1998 in the "Academy of Management Journal" with a citation count of 613.

Table 2. Leading 10 Articles in Research Domain of Agency Theory, based on Total Global Citations.

Article	Authors and Year	Journal	TGC
Control: Organizational and Economic Approaches	(Eisenhardt 1985)	Management Science	1227
Internationalization and firm governance: The roles of CEO compensation, top team composition, and board structure	(Sanders and Carpenter 1998)	Academy of Management Journal	613
Do corporations award CEO stock options effectively?	(Yermack 1995)	Journal of Financial Economics	524
Managing foreign subsidiaries: Agents of headquarters, or an interdependent network?	(O'Donnell 2000)	Strategic Management Journal	473
The choice of performance measures in annual bonus contracts	(Ittner et al. 1997)	Accounting Review	466
Contracting theory and accounting	(Lambert 2001)	Journal of Accounting and Economics	437
Board control and CEO compensation	(Boyd 1994)	Strategic Management Journal	432
Why do corporate managers misstate financial statements? The role of option compensation and other factors	(Efendi et al. 2007)	Journal of Financial Economics	425
Managing knowledge transfer in MNCs: The impact of headquarters control mechanisms	(Björkman et al. 2004)	Journal of International Business Studies	415
Top-Management Compensation and Capital Structure	(John and John 1993)	The Journal of Finance	377

Note: TGC—Total Global Citations.

4.3.2. Local Citations

Local citations refer to the count of all articles in the review corpus that have cited the study (Mukherjee et al. 2022). Alternatively, local citations are the citations received

on the article from the current study sample of 767 articles after the language, scholarly, and subject filtration of the Scopus database. From this study, we find that the article titled "Board control and CEO compensation" published in Strategic Management Journal in 1994 has been cited by 49 articles (6.4%). This is followed by the article titled "Do corporations award CEO stock options effectively?", published in the Journal of Financial Economics in 1995 with a local citation count of 45 articles (5.9%). The article ranking based on local citations is summarized in Table 3.

Table 3. Leading 10 Articles in the Research Domain of Agency Theory based on Total Local Citations.

Article Title	Authors and Year	Journal	TLC
Board control and CEO compensation	(Boyd 1994)	Strategic Management Journal	49
Do corporations award CEO stock options effectively?	(Yermack 1995)	Journal of Financial Economics	45
Executive compensation: A multidisciplinary review of recent developments	(Devers et al. 2007)	Journal of Management	37
Top-Management Compensation and Capital Structure	(John and John 1993)	The Journal of Finance	36
Control: Organizational and Economic Approaches	(Eisenhardt 1985)	Management Science	26
Executive compensation and corporate governance in China	(Conyon and He 2011)	Journal of Corporate Finance	22
Moving closer to the action: Examining compensation design effects on firm risk	(Devers et al. 2008)	Organization Science	22
An empirical investigation of the role of subjective performance assessments versus objective performance indicators as determinants of CEO compensation	(Caranikas-Walker et al. 2008)	Management Research	22
Is CEO pay in high-technology firms related to innovation?	(Balkin et al. 2000)	Academy of Management Journal	22
The choice of performance measures in annual bonus contracts	(Ittner et al. 1997)	Accounting Review	22

Note: TLC—Total Local Citations.

4.4. Prolific Authors and Collaborations

4.4.1. Prolific Authors

The analysis of literature on AP reveals that Kathleen M. Eisenhardt, a professor in the school of engineering at Stanford University, has the highest number of total citations with a count of 1227 citations of articles on agency problems. Her first publication was in the year 1985 entitled "Control: Organizational and economic approaches" wherein she discussed agency theory and control (Eisenhardt 1985). She is followed by the late Mason A. Carpenter of the University of Wisconsin-Madison with 851 total citations in the field. The ranking of authors based on the number of papers published is shown in Table 4. As per the number of documents, Luis Gomez-Mejia of Arizona State University has the highest published on AT (n_p = 11). He is followed by Robert M Wiseman of Michigan State University with eight published articles on AP (see Figure 5).

Table 4. Top Performing Authors in the Research Domain of Agency Theory.

Authors	h-Index	TC	NP	PY-Start
Eisenhardt KM	1	1227	1	1985
Carpenter MA	3	851	3	1998
Gomez-Mejia LR	10	765	11	2000
Lambert RA	4	701	4	1991
Hambrick DC	3	656	3	1995
Sanders WG	1	613	1	1998
Larcker DF	4	581	4	1991
Finkelstein S	2	558	2	1995
Wiseman Rm	6	542	8	2002
Devers CE	3	525	3	2006
Yermack D	1	524	1	1995
Ittner CD	2	486	2	1997
O'Donnell SW	1	473	1	2000
Rajan MV	1	466	1	1997

Table 4. *Cont.*

Authors	h-Index	TC	NP	PY-Start
Boyd BK	2	465	2	1994
Conyon	3	462	3	2006
Bjrkman I	2	431	2	2000
Efendi J	1	425	1	2007
Srivastava A	1	425	1	2007
Swanson EP	1	425	1	2007

Note: Authors are ranked on the basis of total citations received, TC—Total Citations, NP—Number of Publications, PY-Start—Publication Year Start.

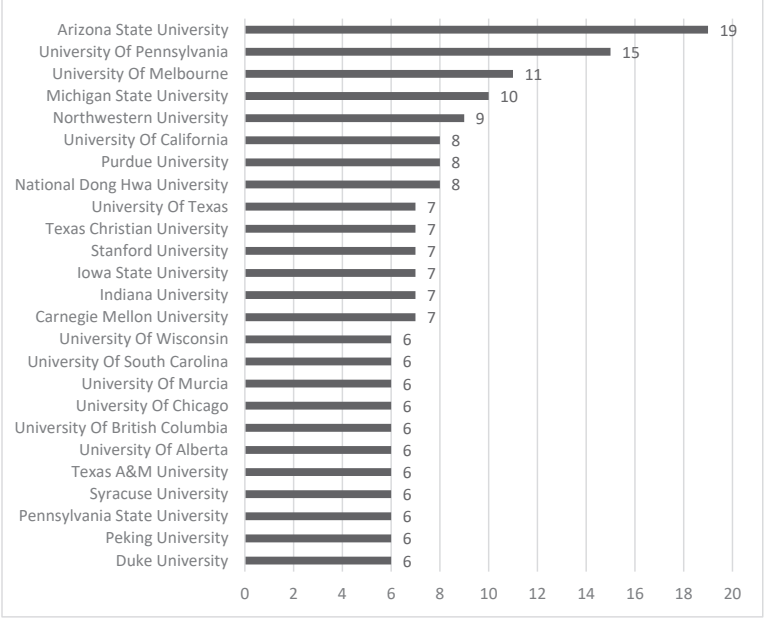

Figure 5. Leading Institutions Contributing to Research on AP (Minimum of Six Research Articles).

4.4.2. Author Collaborations

The co-authorship analysis reveals the nature and groups of authors, which is similar to the social network of researchers working on a common project (Donthu et al. 2021). van Eck and Waltman (2010) stated that the co-authorship networks have been studied extensively; however, the visualization of such networks has been given little attention. The analysis reveals the prominent collaborative groups in Figure 6 on the research topic of AP. The collaborative author group is Luis Gomez-Mejia of Arizona State University, Robert M Wiseman of Michigan State University, Geoffrey Martin of Melbourne Business School, and Herman Aguinis of George Washington University. The size of the circles in Figure 4 resembles the influence of the author. Other collaborative groups include Michael Wolff and Jana Oehmichen of the University of Groningen, Lerong He of State University of New York at Brockport and Martin Conyon of Bentley University, and, lastly in the figure, David F. Larcker of Stanford University and Richard A Lambert of Northwestern University.

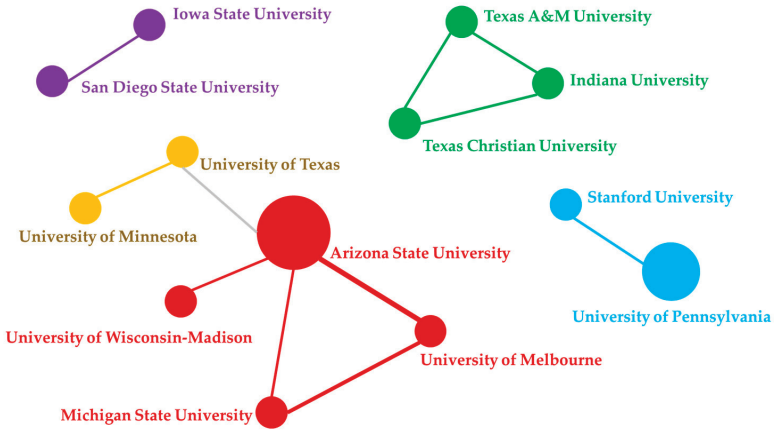

Figure 6. Prominent Collaborators (Institutions) on the Research Topic of Agency Theory.

4.5. Countries

4.5.1. Contributing Countries

Figure 7 summarizes the country-wise academic contributions in the field of AP. Notably, Alaska and United States dominate the field with more than 800 citations in the countries. They are followed by China with cited research in the bracket of 200–400 studies. Other countries that are highlighted in red represent lower impact output within the range of 0–200 citations. The nations that are shown in white color denote no or very little involvement in the academic research in this area.

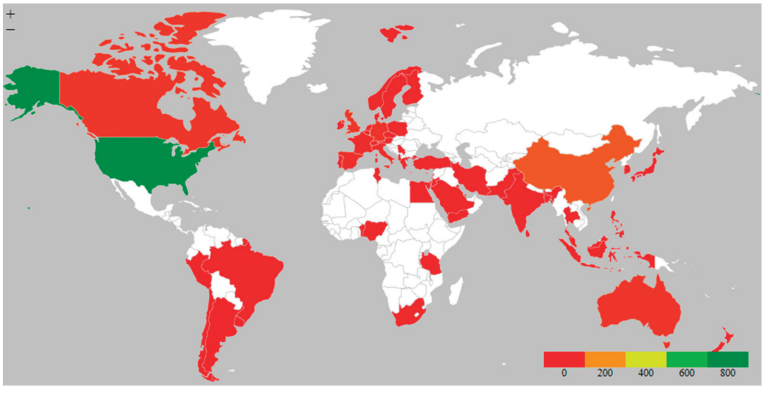

Figure 7. Geographic Heat Map of Countries Contributing to Research on Agency Theory.

4.5.2. Country Collaborations

This study visualizes the country-wise collaborations in the form of a network diagram (Figure 8). Cardoso et al. (2020) presented a country research performance model to evaluate a country's research dominance. They considered the countries' overall performance, the countries' journals' performance, and the countries' institutions' performance to ascertain the countries' research dominance. However, the researchers missed out on studying the cross-country collaborations on the topic. In Figure 8, the country-wise collaboration network is depicted. The countries marked with identical colors are part of the same cluster. The countries in the same clusters are shown to work together over the countries marked with different colors. Five country-wise clusters can be observed from the figure, with the biggest cluster dominated by the USA, China, Canada, and Australia. The second cluster

consists of European countries such as the United Kingdom, Italy, Poland, and Cyprus, along with Pakistan. The third cluster in terms of its size is France, Finland, Norway, and Tunisia. This is followed by the fourth cluster of Belgium, Germany, and Netherlands, and, lastly, a separate and unrelated cluster of Indonesia and Malaysia are shown to have researched together on AP.

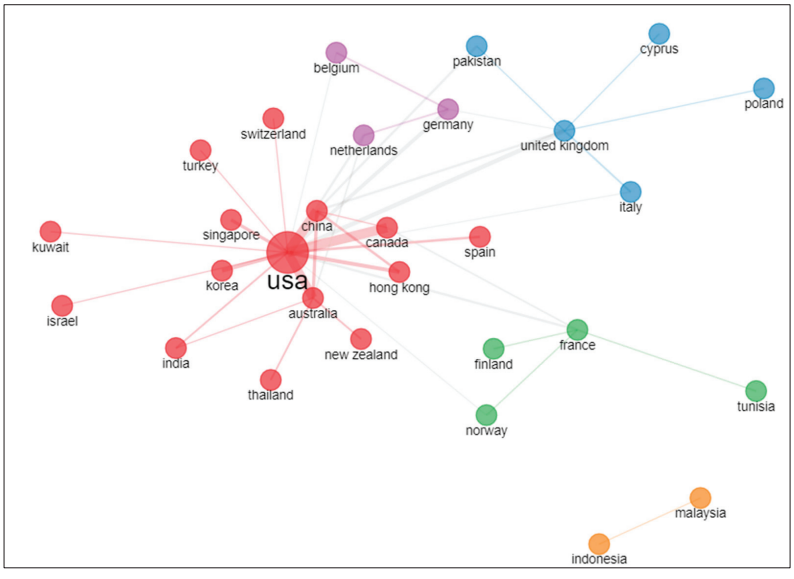

Figure 8. Prominent Collaborators (Countries) on the Research Topic of Agency Theory.

4.6. Institutions

4.6.1. Leading Institutions

The analysis indicates that Arizona State University made the highest contribution to the field of AP in the past with 19 articles published (see Figure 9). This is followed by the University of Pennsylvania with 15 articles. These are followed by the University of Melbourne, Michigan State University, and Northwestern University with eleven, ten, and nine articles respectively. The highest contribution of Arizona State University can be credited to Prof. Luis Gomez-Mejia who is also the leading author in the field. Contrastingly, the contribution of Robert M Wiseman and Richard A Lambert is also significant for boosting the impact of Michigan State University and Northwestern University.

4.6.2. Institutional Collaborations

The network visualization diagram of institutional co-authorship reveals five major collaboration groups (see Figure 10). The biggest group consists of Arizona State University, the University of Melbourne, Michigan State University, and the University of Wisconsin-Madison. The next group consists of Texas A&M University, Indiana University, and Texas Christian University. The two groups are followed by collaborative duos of Stanford University–University of Pennsylvania, Iowa State University–San Diego State University, and University of Texas–University of Minnesota.

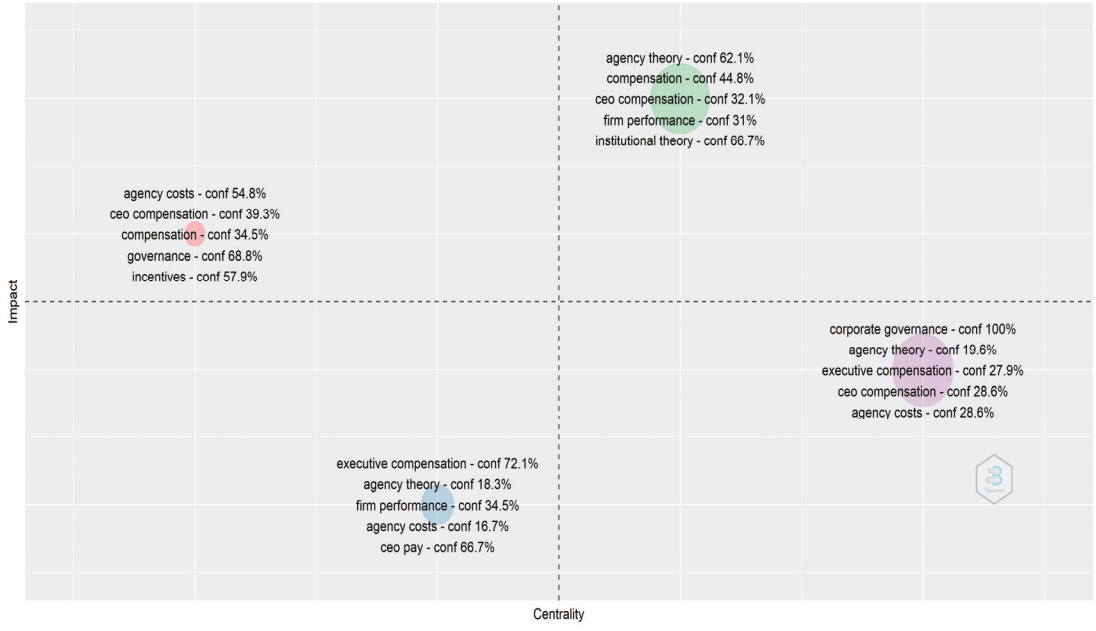

Figure 9. Knowledge Clusters Identified as a Result of "Bibliographic by Coupling" Analysis.

4.7. Themes

The bibliographic coupling of documents is used to form knowledge clusters. The knowledge clusters contain documents of similar themes underlining the thematic structure of AP. Following the methodology shared by Kumar et al. (2021), we form knowledge clusters by the bibliographic coupling of documents based on authors' keywords. Four knowledge clusters are formed from the analysis; Table 5 summarizes the keywords and their occurrence for each cluster. The knowledge clusters are also plotted in Figure 9 based on their centrality and impact. Centrality in bibliometric research refers to the prominence of a publication or author within a scholarly network, often measured by the number and strength of connections. Impact of the cluster assesses the influence and significance of a research output, typically measured by citations and other indicators of scholarly impact (Sahoo et al. 2023). Impact measures the extent to which a research output is cited and acknowledged within the context of the discussed theme, highlighting its influence and relevance in the scholarly discourse (Sahoo et al. 2022). Table 6 lists the top ten most relevant documents for each cluster.

Table 5. Descriptive Summary of Formed Knowledge Clusters.

#	Knowledge Cluster	Keyword (% of Occurrences)	Frequency	Centrality	Impact
1	Corporate Governance	Agency costs (54.8%), CEO compensation (39.3%), compensation (34.5%), governance (68.8%), and incentives (57.9%)	90	0.08	2.58
2	Agency Costs and Governance	Executive compensation (72.1%), agency theory (18.3%), firm performance (34.5%), agency costs (16.7%), and CEO pay (66.7%)	106	0.21	2.42
3	Agency Theory and Compensation	Agency theory (62.1%), compensation (44.8%), CEO compensation (32.1%), firm performance (31%), and institutional theory (66.7%)	150	0.21	2.70
4	Executive Compensation and Agency Costs	Corporate governance (100%), agency theory (19.6%), executive compensation (27.9%), CEO compensation (28.6%), and agency costs (28.6%)	154	0.24	2.44

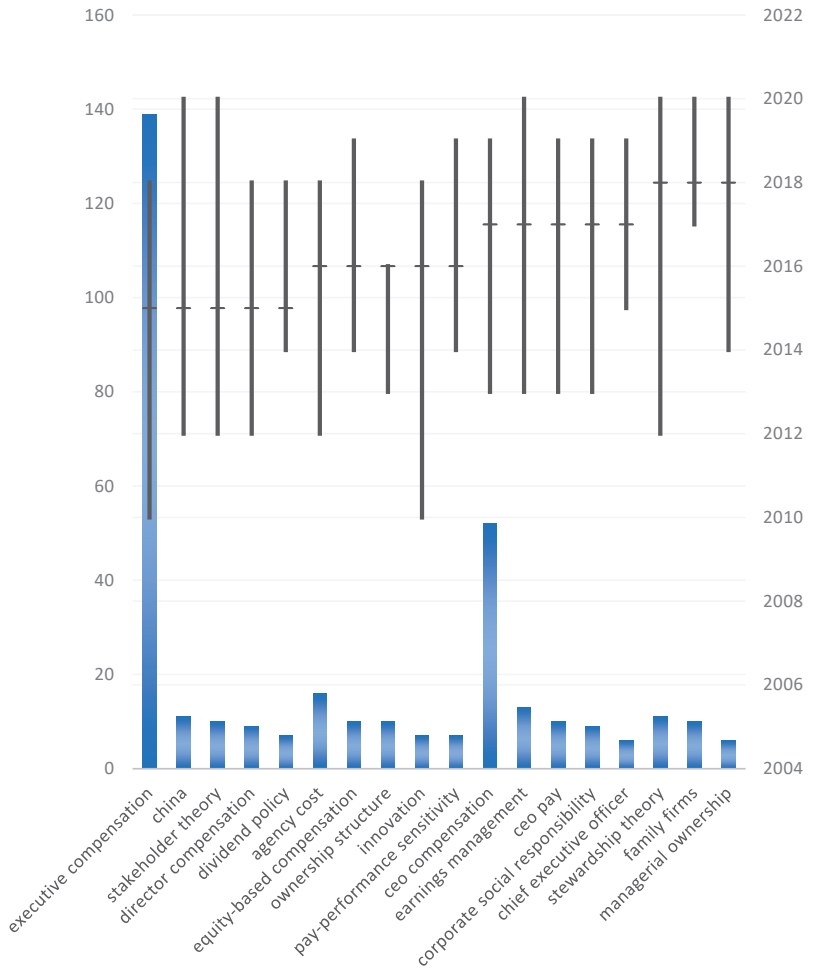

Figure 10. In-trend keywords on the research in the field of AT over the past seven years.

The first cluster comprises research articles on Corporate Governance. Westphal and Zajac (1995) suggested that high incentives and monitoring costs are not optimal. A firm's strategy should focus on corporate governance implications equally as product and market implications. Devers et al. (2007, 2008) in their studies on executive compensation factors and their robustness, revealed that no theoretical model is strong enough to determine optimal executive compensation. van Essen et al. (2012) find that strong directors can establish tighter links between executive pay and firm performance. Scholarship has further highlighted that CEOs that have higher board influence enjoy higher compensation packages and only shareholders and their agents can control them. The articles in this cluster are highest in terms of centrality to the theme of AP and have a high impact on the literature.

Table 6. Most relevant documents cluster-wise sorted on normalized local citation score.

Cluster	Documents	Cluster Size	Normalized Local Citation Score
Cluster 1: Executive Compensation and Governance			
1	(Brockman et al. 2010)	90	5.76
1	(Bolton et al. 2015)	90	2.18
1	(Gillan et al. 2021)	90	1.84
1	(Dhole et al. 2016)	90	1.78
1	(Ertugrul and Hegde 2008)	90	1.33
1	(Masulis and Reza 2015)	90	1.09
1	(Eisdorfer et al. 2015)	90	1.09
1	(Berry and Junkus 2013)	90	1.05
1	(Imes and Anderson 2021)	90	1
1	(Khandelwal and Chotia 2022)	90	1
Cluster 2: CEO Compensation			
2	(Conyon and He 2011)	106	9.2
2	(van Essen et al. 2012)	106	7.62
2	(Andreas et al. 2012)	106	5.58
2	(Michiels et al. 2013)	106	4.25
2	(Hong et al. 2016)	106	3.57
2	(Callan and Thomas 2014)	106	3.36
2	(Smirnova and Zavertiaeva 2017)	106	3.32
2	(O'Reilly and Main 2010)	106	2.88
2	(Sun and Shin 2014)	106	2.52
2	(Sheikh et al. 2019)	106	2.4
Cluster 3: Agency Theory			
3	(Nyberg et al. 2010)	150	5.35
3	(Francoeur et al. 2021)	150	3.32
3	(Coles et al. 2001)	150	2.96
3	(Cuevas-Rodríguez et al. 2012)	150	2.79
3	(Datta et al. 2009)	150	2.66
3	(Dawar 2014)	150	2.66
3	(Kolev et al. 2014)	150	2.49
3	(Sun et al. 2010)	150	2.47
3	(Miller et al. 2013)	150	2.33
3	(Lin 2005)	150	2.23
Cluster 4: Corporate Governance			
4	(Devers et al. 2007)	154	10.42
4	(Devers et al. 2008)	154	7.33
4	(Conyon and He 2012)	154	4.46
4	(Aguinis et al. 2018)	154	4
4	(Conyon 2006)	154	3.68
4	(Mengistae and Xu 2004)	154	3
4	(Weinstein and Ryan 2010)	154	2.96
4	(Core et al. 2003)	154	2.79
4	(Karim et al. 2018)	154	2.4
4	(Coen et al. 2022)	154	1.85

The second cluster is the smallest cluster in size, focusing on Agency Costs and Governance. Researchers in this cluster have studied: (i) Agency costs arising due to governance hazards (Lambert 2001), (ii) Tax evasion and its impact on agents and principals (Crocker and Slemrod 2005), (iii) Relationship of free cash flows and governance (Jabbouri and Almustafa 2021), (iv) Ownership concentration and agency costs (Pandey and Sahu 2019). Scholars find that accounting disclosures authorized by agents can be misleading and can manipulate stock prices (Lambert 2001). Scholars also highlight earnings management as a reason for agency costs. Agents tend to follow reporting standards that benefit their pocket at the expense of principals (Michiels et al. 2013). Research in this cluster has a high impact on AP literature but lacks centrality.

The third cluster comprises articles around APs focusing on Agency Theory and Compensation. Scholars listed out determinants of a suitable pay structure for executives and have tested them empirically. Ittner et al. (1997) list out performance measures for determining bonus structures of executives. O'Donnell (2000) criticized AT for its prediction ability for the management of international subsidiaries. She stated that the model based on intra-firm interdependence has higher predictive power in comparison to AT. Björkman et al. (2004) linked the managerial compensation structure of MNCs with knowledge transfer mechanisms; however, they could not find support for their proposal. Another branch in this cluster is observed with the use of CSR as an employee governance tool. Flammer and Luo (2017) suggest the integration of CSR-based governance in strategic planning. Employee governance on CSR practices is proven to mitigate employee absenteeism, shirking, and employee theft and fraud. This cluster is also the highest in terms of research impact and identifies compensation and social governance as the road to minimizing agency costs.

The fourth cluster consolidates studies on Executive Compensation and Agency Costs. Panda and Leepsa (2017) suggested the use of variable compensation on profits as motivators for executives. If the principals and agents will benefit from a common thing, occurrences of AP can be minimized. Yermack (1995) states that performance incentives in form of cash rewards and stock options relate to agency cost reduction. Efendi et al. (2007) stated that performance-based benefits often lure managers to misstate accounting facts. Authors state that in the post-1990s market bubble world, the likelihood of cooked financial statements increased as CEOs have sizable holdings in the form of stock options. They also argue that agency costs also arise due to overvalued equities as managers try to maximize the value of their stock options in shorter runs. Chou and Buchdadi (2018) find that dynamic compensation structures have increased executive attrition and led to an increase in residual losses. Consistent with Conyon and He (2011), they found that performance-linked incentives are lower in state-owned firms and organizations with concentrated ownership. Their study also highlights the country-based differences with the example that executive pay for US managers is seventeen times higher than Chinese managers, proving that the agency costs differ on a geographic basis.

4.8. Topics

The keywords are analyzed by the bibliographic coupling technique to assess the use of keywords over the years (Agbo et al. 2021). The trend topics package in biblioshiny plotted the keywords by use frequency and years of most use (Figure 10). The article count (left axis) and year of publication (right side) are plotted on the Y-axis, whereas the prominent keywords over the past seven years are plotted on the X-axis. The analysis reveals that the researchers have studied executive compensation the most in the last seven years (n = 139). The majority of studies in the field began during 2010 and have a median year of study of 2015, considering research articles up to 2021. The upcoming research topics are identified as managerial ownership, family firms, and stewardship theory, respectively, as they have the most recent median years of study.

4.9. Discussion

The performance analysis of this bibliometric study addresses the research questions posed at the outset, shedding light on various facets of the AP field. Firstly, the study captures the evolving trend in AP publications, revealing a notable increase in scholarly engagement over the past 36 years, with a peak in 2021. Secondly, the identification of influential publishing outlets, with a focus on journals such as 'Strategic Management Journal', 'Academy of Management Journal', and 'The Journal of Financial Economics', provides valuable insights for researchers seeking impactful platforms for AP research dissemination. Thirdly, the analysis of prolific contributors highlights key individuals shaping the field, with scholars like Kathleen M. Eisenhardt and Mason A. Carpenter emerging as influential figures. Fourthly, the thematic clusters uncovered in the analysis, including Corporate Governance, Agency Costs and Governance, Agency Theory and Compensation, and Executive Compensation and Agency Costs, provide a comprehensive overview of the diverse research themes and clusters within AP. Fifthly, the study identifies emerging research areas, with a focus on managerial ownership, family firms, and stewardship theory, offering valuable guidance for future investigations in the AP domain. The next sections provide the research areas that should be explored by academic scholarship.

5. Further Research Agenda

The latest trends and topics for study are presented in this section to provide insights on the recent research. With the reading of the top ten research papers from each knowledge cluster and scrutiny on trend topic analysis, we draw attention to the following listed gaps and ongoing research streams (Figure 10).

5.1. Managerial Debt and Firm Performance

Research highlights that the use of short-term debt mitigates the agency costs of the firm by constraining CEOs' risk-taking preferences. Brockman et al. (2010) studied the impact of duration of debt on managerial risk-taking, thus minimizing the agency costs to the firm. Dhole et al. (2016) highlight that inside debt counteracts the CEOs' motivation to smooth earnings through earnings management; thus, CEOs are proven to be effective when they hold higher stakes of inside debt. Managerial debt is compared with multiple proxies of firm performance, and much research is going on in this area. Scholars (Harris and Raviv 1991; Naveed Kashan and Siddiqui 2021) have pointed out that debt commits the firm to pay out money in the form of interest payments, thereby leaving less 'free cash flow' for the managers to engage in selfish pursuits.

5.2. CEO Pay of Family-Owned Companies

Numerous studies have been conducted to see the impact of a CEO's origin on the performance of the business. While this issue may be subjective, some studies have found a difference in the leadership of a professional CEO hired from outside with one hired from the controlling family. Denis and Osobov (2008) highlighted the importance of studies on corporate governance before the millennium. Michiels et al. (2013) discuss the CEO pay structure of the private family-owned firms against the non-family-owned firms and find that the pay-for-performance relation is lower in family-owned firms. Kyung et al. (2021) stated that CEO compensation varies with type of investors and their stakes. On the contrary, Delgado-García et al. (2023) found that family firm CEOs have higher compensation in comparison with non-family CEOs. The contrasting findings of studies coupled with the trendiness of the topic indicate the need for further research.

5.3. CEO Compensation and Sustainability

Masulis and Reza (2015) found that CSR expenditures are linked with CEOs' image. A hike in societal expenditure is likely to benefit the management's public image, but at the same time will reduce net profits and, thus, shareholder's earnings. Francoeur et al. (2021) show that environment-compliant firms offer their CEOs less total compensation

and are less dependent on incentive-based compensation than environmentally carefree firms. Karim (2020) finds that the remuneration patterns of CEOs and executive directors linked with socially responsible activities tend to a reduction in agency costs. Additionally, they find that having independent and executive female directors are linked with lower compensation for executives.

5.4. CEO Compensation and Corporate Governance

Westphal and Zajac (1995) suggested that a firm's strategy should focus on corporate governance implications equally as product and market implications. Devers et al. (2007) shared the theoretical framework for compensation models of top executives. He addressed the ongoing debate on determinants and consequences of executive compensation while asking scholars to take forward their work. Luo et al. (2023) evaluated the components of executive compensation and found a positive relationship with the firm performance of Chinese public firms. The researcher finds that incentives to top executives result in better firm performance as compared to non-incentivized executives.

5.5. Economic Value Added and Employee Compensation

Studies reveal that there is a positive relationship between the Economic Value Added (EVA) and executive compensation. A few studies also claim that high-paid managers are more arrogant and are more prone to agency issues (Brahmana et al. 2020). Chen et al. (2015) suggest using governance measures to bring down agency costs. Tripathi et al. (2023) suggest the methodology to calculate EVA and regress it with executive compensation. Eliwa et al. (2023) study the impact of governance indicators (board size, minority representation, appointment of family directors) on the EVA of listed companies, thereby suggesting an impact on the firm value.

5.6. Stakeholder Theory

As outlined by Kahler (2011), the stakeholder theory suggests that instead of amassing shareholders' wealth, the management should work towards the fulfillment of a variety of goals. The theory shifts the perspective from an organization's shareholders to its stakeholders. According to Freeman et al. (2018), stakeholders are individuals or a group of individuals who can affect or get affected by organizations' decisions. Freeman et al. (2018) carefully noted that any theory that redistributes decision-making ability was open to exploitation by non-shareholders. The reallocation of power from wealthy shareholders to the comparatively less wealthy stakeholders could potentially maltreat the existing shareholders who have put in funds as capital.

5.7. Stewardship Theory and Agency Theory

The works of both stewardship and agency theories can be used to work out principal–agent relationships for non-profit firms (Chrisman 2019). The stewardship-based approach presumes that non-profit firms are motivated to act for benefit of their donors (principals). Peck et al. (2021) suggest that a manager (steward), if independent and given a choice in self-sustaining behavior or cooperation with the company (lord), will favor cooperation with the owners. Chrisman (2019) recommends the use of stewardship theory over AT for family firms. He states that the lack of assumptions in stewardship theory makes it more realistic for firms to implement. He provided observations on how to bolster stewardship theory for the study of family firms by rectifying its assumptions on models of man, goals, and control, and asked scholarship to empirically verify more domains of stewardship theory.

6. Conclusions

Entrepreneurship is critical to economic development, and constant research is needed to figure out problems relating to agency issues and their solutions for both the principals and the agents. In conclusion, the extensive literature review conducted offers valuable

insights into the intricate dynamics of agency problems and their profound impact on firm performance. While the exploration covered various facets such as managerial debt, CEO compensation, stakeholder theory, and stewardship theory, the need for a more focused examination of the relationship between agency theory and firm performance is acknowledged. Despite the breadth of topics discussed, the concern raised about the clarity of future research gaps is valid.

To address this, emphasis is placed on the pivotal intersection of agency problems and firm performance as a central theme for future investigation. Specifically, a more nuanced exploration into the interplay between agency mechanisms and their direct implications on business outcomes is warranted. By honing in on specific dimensions within the agency theory framework, such as the effectiveness of mitigating agency costs or the optimization of governance structures, researchers can contribute more directly to the ongoing discourse. Furthermore, scholars are encouraged to delve deeper into the determinants of agency costs and devise innovative strategies to minimize them, providing actionable insights for both academics and practitioners. By narrowing the focus and delineating clear avenues for future research within the broader context of agency problems and firm performance, aspirations are set to enhance the scholarly contributions in this critical field of study.

Theoretical implications of this study extend to refining our understanding of agency issues and their intricate connections with corporate performance, contributing to the ongoing theoretical discourse in the field. Managerially, the findings underscore the significance of informed decision-making in mitigating agency problems for improved corporate performance. As practitioners navigate the complexities of agency relationships, the insights derived from this study can serve as a strategic guide, fostering more effective governance structures and practices within organizations.

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The Influence of ESG, SRI, Ethical, and Impact Investing Activities on Portfolio and Financial Performance—Bibliometric Analysis/Mapping and Clustering Analysis

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Abstract: This paper aims to examine the publication metrics of literature related to the influential aspects of ESG (environmental, social, and governance), SRI (socially responsible investing), ethical, and impact investing on the portfolio and financial performance literature. It also seeks to identify major patterns and core themes in this topic and draw lessons from the past literature for future directions. Data from the SCOPUS database were used in this study. The 'biblioshiny' R package, also known as 'bibliometrix 3.0', was employed to conduct bibliometric analysis, utilising mapping and clustering techniques on 260 articles, in order to distil the comprehensive knowledge and identify emerging trends in ESG, SRI, ethical, and impact investing. The thematic map classified the ESG, SRI, ethical, impact investing and performance relationship themes into four categories of themes: niche themes (SRI, engagement and ESG), motor themes (corporate financial performance, corporate social performance, ESG, ESG factors, sustainability, performance, integrated reporting, gender diversity, and board size), emerging or declining themes (social responsibility, environmental performance, socially responsible investment, ethical investment, and SRI), and basic or transversal themes (financial performance, corporate social performance, ESG performance, environmental, social, and governance). Socially responsible investing, engagement, and ESG imply a position between niche themes and a highly developed topic/emerging or a decreasing theme, while the impact of COVID-19 on sustainability and financial performance implies a position between a highly developed topic/emerging or decreasing theme and a basic theme. The findings contribute to the enhanced understanding of ESG, SRI, ethical, impact investing and performance, which are crucial for an efficient capital market in promoting sustainability and sustainable development. The study offers vital practical implications and future research directions.

Keywords: ESG; SRI; bibliometric analysis; publication metrics

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1. Introduction

Although there are important differences, the terms environmental, social, and governance (ESG), socially responsible investing (SRI), and impact investing are often used interchangeably. Besides typical financial indicators, ESG considers the company's ESG activities (Zhou 2019). Additionally, SRI entails selecting or rejecting assets based on certain ethical standards (Zhou 2019). The SRI concept or responsible investment (RI) has emerged to be highly relevant among numerous investors in recent decades and gained increasing attention within academic literature (Derwall et al. 2011; Sievänen et al. 2013). As stated by the European Social Investment Forum (Eurosif 2016), SRI can be comprehended as a long-term-oriented investment method that targets integrating ESG factors into decisions concerning investments. In the economics literature, corporate social responsibility (CSR) is another commonly used term for ESG factors (Liang and Renneboog 2020; Gillan et al.

2021). The Principles for Responsible Investment (PRI) (2015) outlined that ESG investment is an approach that focuses on improved risk management and better sustainability in long-term returns. An increasing number of investors are attempting to make organisations act responsibly besides only delivering financial returns.

The bibliometric analytical technique (Gao et al. 2021; Arslan et al. 2022; Bosi et al. 2022; Ellili 2022; Galletta et al. 2022; Khan 2022; Passas et al. 2022; Rodríguez-Rojas et al. 2019; Senadheera et al. 2022) utilised in the present paper is proposed to examine the research on ESG. Galletta et al. (2022) conducted a bibliometric analysis on 271 publications retrieved from the Web of Science (WOS) to examine intellectual development, authors' characteristics, and ESG-related manuscripts in the banking industry and assess research trends. Nevertheless, the bibliometric analysis conducted only included publications that dealt with ESG performance within the banking sector. Bosi et al. (2022) only examined publications that discussed ESG performance, specifically in the banking industry, using bibliometric analysis. In contrast, Khan (2022) and Ellili (2022) conducted bibliometric analyses that focused on publications about ESG disclosure and firm performance. Passas et al. (2022) analysed 228 publications related to ESG controversies by using bibliometric analysis to examine the key characteristics and ESG controversy trends in the European market. Gao et al. (2021) used various bibliographic approaches, including co-occurrence analysis and bibliographic coupling, to ascertain the publishing trend of ESG research from 1980 to 2020. The authors used SCOPUS data from 314 publications that included ESG-related material, although the field is vast. There is a conspicuous absence of literature reviews that have endeavoured to investigate the burgeoning realm of ESG without imposing excessively restrictive constraints. For instance, Gao et al.'s (2021) review evince that overly rigorous criteria are employed to cull the corpus of literature for review to a practicable extent.

Thus, the present study considerably expands on Gao et al.'s (2021) study by eliciting insights that they were unable to offer due to the intrinsic restriction of keywords chosen, which reduced the number of results available for their analysis. The present study also expanded Widyawati's (2020) study by evaluating ESG, SRI, ethical, and impact investing publication data from 2013 to 2022 by utilising bibliometric analysis as opposed to systematic literature reviews. The bibliometric analysis, through visualisation and quantitative bibliometric tools, is viewed as complementary to the qualitative systematic literature review as it paints a picture of the state of the art in a specific research line (Liao et al. 2018). According to Gao et al. (2019), bibliometrics is attractive as it enables researchers to examine research topics by analysing citations, co-citations, geographical distribution, and word frequency. It assists in drawing insightful conclusions, including the most prominent institutions, noteworthy authors, and influential journals. It offers a visual on knowledge development, the latest trends in research, and future directions regarding the topic.

The aim of the study was to conduct a bibliometric analysis of all publications related to the influence of ESG, SRI, ethical, and impact investing on portfolio and financial performance on SCOPUS. Bibliometric analysis, which is a quantitative review technique known for its objectivity and effectiveness, was employed due to its suitability in analysing fields with a large corpus of articles (Pattnaik et al. 2020; Donthu et al. 2021; Paul and Bhukya 2021). A comprehensive examination of research progress could provide a meticulous assessment of various scientific aspects inherent in ESG, SRI, ethical, impact investing and performance in this context. Among the parameters utilised are the document type (all), publication language (English), and subject areas (accounting, business, economics, econometrics, finance, management, and social science). The study also examines the author, the publication models, thematic category distribution, the author's keyword distribution, publication country, and most frequently cited articles. The diverse rankings of bibliometric analysis emphasise the multidimensional nature of the scientific impact. Moreover, this type of analysis provides a notable illustration of how big data analytics and machine learning can be effectively utilised to facilitate academic research in two crucial ways:

(1) The search for big data through bibliometric analysis is conducted on SCOPUS, an AI-powered scientific database. The database employs specified keywords for supervised machine learning, a subset of AI, to obtain extensive bibliometric data on articles related to the influence of ESG, SRI, ethical and impact investing on portfolio and financial performance.
(2) Bibliometric analysis, as a form of big data analysis, is characterised by its multifaceted nature, which includes various dimensions such as keywords, authorship, journal, institution, and country. The analysis also involves different formats, such as words and numbers, and it deals with a large-scale dataset comprising thousands of data points across multiple facets of 1319 articles. To uncover latent relationships and major themes, unsupervised machine learning techniques, which are a subset of artificial intelligence, are utilised to analyse the data.

Thus, this study attempted to synthesise the literature related to the influence of ESG, SRI, ethical and impact investing on portfolio and financial performance to determine the latest trends, key themes, authors, and influential journals in recent years. In response to recent demands for more comprehensive research on this subject, this study seeks to take a broader approach and answer the following three research questions:

RQ1. What are the most influential aspects of the influence of ESG, SRI, ethical and impact investing on the financial and portfolio performance literature?

RQ2. What are the major patterns and core themes in this topic?

RQ3. What lessons can be drawn from the past literature to plan for the future, and what future agendas can be set?

In various respects, the study strengthens current research in ESG, SRI, ethical and impact investing, and business literature. Initially, big data technology termed bibliometric analysis was utilised to offer a comprehensive synthesis of this fragmented literature. Additionally, the study emphasises significant milestones in this field of study, such as notable publications, authors, journals, and institutions. This analysis also recognises the prevailing research trends and themes in the discipline. Finally, the research offers managers, policymakers, and regulators recommendations for the impact of ESG, SRI, ethical and impact investing on financial and portfolio performance. Lastly, the study suggests ways for researchers to broaden the scope of their research.

The article is structured as follows: Section 2 presents the materials and methods used in the study. Section 3 investigates the significant attributes of the research. Subsequently, Section 4 discusses the conceptual framework of the study. Section 5 provides an analysis of the findings, while Section 6 presents a summary of the study.

2. Materials and Methods

2.1. Five Steps of Bibliometric Analysis

This article follows a bibliometric workflow, which is a five-step method proposed by Silvente et al. (2019). Figure 1 depicts the five phases of the bibliometric study. This research was conducted using an objective and dependable approach to cover three levels of analysis: sources, authors, and documents. Initially, the research concentrated on determining the relevance of issues associated with each level. In this context, relevance has been defined as the most productive or referenced item, depending on the unit of analysis. Second, knowledge structures were determined using various bibliometric methodologies. Specifically, conceptual structures were examined in terms of major topics and trends, intellectual structures regarding how individual works affect the scientific community, and social structures concerning author–country cooperation. The study was conducted using the bibliometric R-Tool (Aria and Cuccurullo 2017). The recently released R package enables a highly comprehensive bibliometric analysis through utilising specialised tools for bibliometric and scientometric quantitative research.

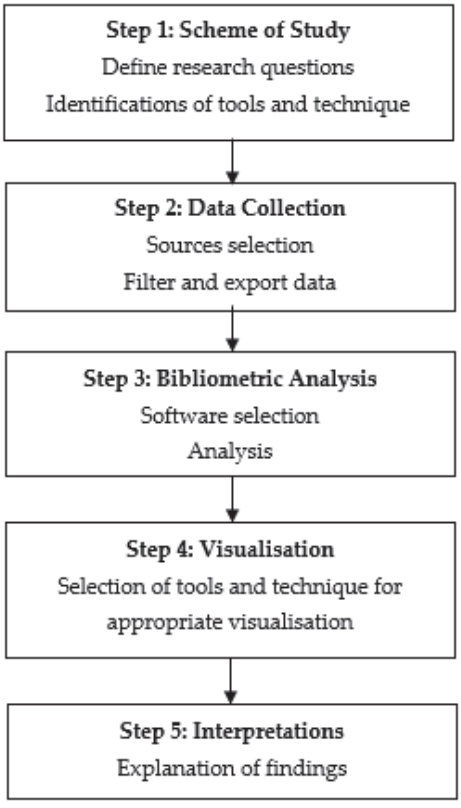

Figure 1. Process of bibliometric analysis. Source: Arslan et al. (2022).

In this context, R is one of the most powerful and versatile statistical software environments available, offering a path to involvement through open source. Thus, R is a collection of integrated software programmes for data processing, computation, and visualisation. In the case of bibliometrics, connecting it with other pertinent software packages is feasible. For example, the 'biblioshiny' package in RStudio is utilised to enhance the paper's content analysis. The processes adopted to conduct the bibliometric analysis included data collecting and descriptive and bibliometric analysis by level.

2.2. Scheme of Study

Numerous concerns posed by the present global environment have to be addressed. The present study attempts to address RQ1 (What are the most influential aspects of the influence of ESG, SRI, ethical and impact investing on financial and portfolio performance literature?) by conducting a descriptive analysis and identifying key sources, publications, authors, countries, and affiliations within the relevant publications. Net publications (NP) per year, total citations, and source influence were used for authors and core sources. In order to categorise the primary sources, Bradford's Law was employed to divide the sources into three zones. Area 1, or the nuclear zone, is the most active zone, followed by Zone 2, which is moderately active. Subsequently, compared to Zone 1 and Zone 2, Zone 3 is barely productive (Viju and Ganesh 2013). The study suggests the top countries and affiliations according to the frequency of publications and total citations.

To address RQ2, co-occurrence maps, thematic maps, and thematic evolution were utilised to detect significant patterns and topics within the literature. The authors' keywords and system-generated keywords (known as "keywords plus") from the chosen works were

employed to recognise research streams and themes within the bibliometric tool called "biblioshiny", which is provided by the R-programme. The keywords given by the author in an article indicate the study's important content. The co-occurrence and intensity analysis of keywords in a research area allows for the discovery of research hotspots and frontiers. The affinity of certain phrases appearing together to suggest the field's conceptual structure is shown by keyword co-occurrence analysis. The clustering analysis of keywords produces a map that represents the network of interrelationships between the phrases (Zupic and Čater 2015). The study's future research plan is developed on the findings for RQ3.

2.3. Objectives, Tools, and Technique

This paper conducts a bibliometric analysis by adopting a mapping and clustering analysis on topics related to the influence of ESG, SRI, ethical, and impact investing on portfolio and financial performance. The web-specific R package 'biblioshiny' (also known as 'bibliometrix 3.0') was utilised to explore influential aspects, identify patterns and core themes, and draw lessons from the past literature for future directions. The primary objective is to use descriptive analysis to identify the most significant factors by utilising various research tools accessible through the biblioshiny GUI, including Bradford's Law, global citation, h-index, g-index, and m-index. The second objective is to determine the primary sources and themes of the study, which will be accomplished through the scientific mapping approaches of conceptual structure and authors' keywords and keywords plus, using them as input data. Once objectives 1 and 2 are addressed, the study then offers a brief interpretation and recommends future study priorities.

2.4. Composing of Bibliometric Data

This analysis chose to utilise one database, SCOPUS, which is a larger database than WOS. The additional coverage is beneficial for mapping smaller research topics implicitly covered by the former (Zupic and Čater 2015). In order to choose which papers to include in the study, the procedures involved in data synthesis must be identified. As per previous prior bibliometric studies (Arslan et al. 2022; Bosi et al. 2022; Ellili 2022; Gao et al. 2021; Passas et al. 2022; Khan 2022; Senadheera et al. 2022), the SCOPUS database was employed to choose the related literature. The final search query is (TITLE ABS-KEY ("ESG" OR "environment*, social, and governance" OR "Sustainab*" OR "social responsible invest*" OR "impact invest*" OR "ethic* invest*" AND "financial performance" OR "portfolio performance") (Figure 2). On 31 March 2023, the search was performed on the SCOPUS database. During the initial search, 1377 publications were found that appeared to be related to the topic being studied. Out of the initial pool of publications, 1117 were removed as these papers did not meet the specified criteria such as the contents being unrelated to the topics, duplications, and not encompassing all aspects of ESG, SRI, ethical investing and impact investing, along with financial and portfolio performance. This process resulted in a final set of 260 publications. According to studies that have analysed the linked subject, the most relevant publications on the topic which were chosen include 260 from 159 sources from 2013 to 2022. Since the focus of this article is to assess the latest trend of ESG, SRI, ethical and impact investing research, the time span was limited to the previous ten years. The discipline category is confined to accounting, business, economics, econometrics, finance, management, and social sciences.

The subsequent stage was to analyse the indications in the data after cleansing the data from the literature. In bibliometric analysis, performance evaluation, and scientific mapping, two main types of indicators (Durieux and Gevenois 2010) are commonly utilised in the literature. The number of citations and publications are used to assess productivity and impact in performance analysis. The objective of scientific mapping is to represent information from the literature in a clear and visual manner that highlights the research dynamics and structure of the field.

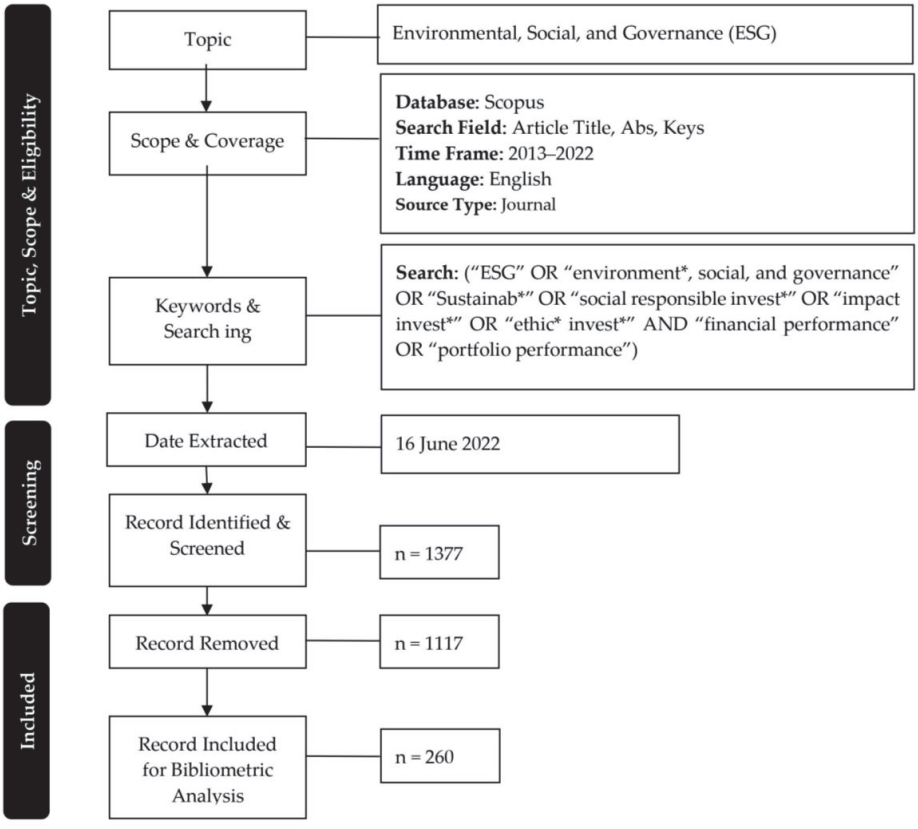

Figure 2. Flow diagram of the search strategy. Source: Zakaria et al. (2020).

2.5. Bibliometric Analysis and Visualisation

Biblioshiny is an R-programme designed for individuals without coding experience, which offers comprehensive scientometric and bibliometric analysis options that are categorised into sources, records, authors, and conceptual, social, and intellectual structures (Moral-Muñoz et al. 2020). The descriptions of the datasets are supplied in bibliometric style to help clarify the knowledge structure of the research linked to ESG, SRI, ethical and impact investments. All linked articles that matched the search query were assessed using the criteria listed in Table 1. The criteria include that the time spans from 2013 to 2022, covers 260 articles from 159 publications, with 262 keywords plus and 704 authors' keywords. The average number of citations per document is 26.55. On average, each document in the dataset has been cited about 27 times by other scholarly works. This indicates that the documents in the dataset are fairly well cited and have likely had some impact in the scholarly community. The average number of citations per year per document is 5.392. This means that, on average, each document in the dataset has received about 5 citations per year since it was published. This metric provides a sense of how frequently the documents in the dataset have been cited over time and suggests that they continue to be relevant and influential in the field. The dataset includes 14,731 references, which indicates that the documents draw on a wide range of prior research and scholarship in the field. The dataset contains a total of 624 different authors, who collectively appear 685 times as authors or co-authors of the documents in the dataset. This means that there are 624 unique authors who have contributed to the documents in the dataset, and some of them have contributed to multiple documents. This indicates that there is a relatively

diverse set of contributors to the field, with many individuals contributing to multiple documents. The collaboration index is 2.81, indicating that, on average, documents in the dataset have just under three co-authors. Overall, these findings suggest that the dataset is a diverse and well-cited collection of research on the topic of interest.

Table 1. Descriptive characteristics.

Description	Results
Timespan	2013:2022
Sources (Journals, books, others)	159
Document type: Articles	260
Average years from publication	3.22
Average citations per document	26.55
Average citations per year per doc	5.392
References	14,731
Number of Article	260
Keywords plus (ID)	262
Author's keywords (DE)	704
AUTHORS	
Authors	624
Author appearances	685
Authors of single-authored documents	47
Authors of multi-authored documents	577
AUTHORS COLLABORATION	
Single-authored documents	55
Documents per author	0.417
Authors per document	2.4
Co-authors per documents	2.63
Collaboration index	2.81

Figure 3 depicts the yearly output of ESG, SRI, ethical, impact investing and performance publications. The publications were significantly low from 2013 to 2015. Nevertheless, there was a sharp increase in the number of articles published in the subject areas in 2016 and it continues to grow to 93 articles in 2022. Figure 4 depicts a three-field (from left to right, keywords, nations, and their affiliation) examination of research on the link between financial and portfolio performance and ESG, SRI, impact investing, and ethical investing. In this literature, the most notable affiliations are India, the United States (USA), Malaysia, Italy, Germany, and France. Financial performance is the most-used keyword (for example, corporate financial performance (CFP), CSR, financial performance, firm performance, sustainability, and sustainable development). Universities from Malaysia and India are the most contributing affiliations, such as Universiti Teknologi Mara, Christ—Deemed to be University, followed by other high-contributing affiliations, such as the Nord University, Universiti Tenaga Nasional, Universiti Utara Malaysia, and the Bucharest University of Economic Studies.

Figure 3. Annual publication trends.

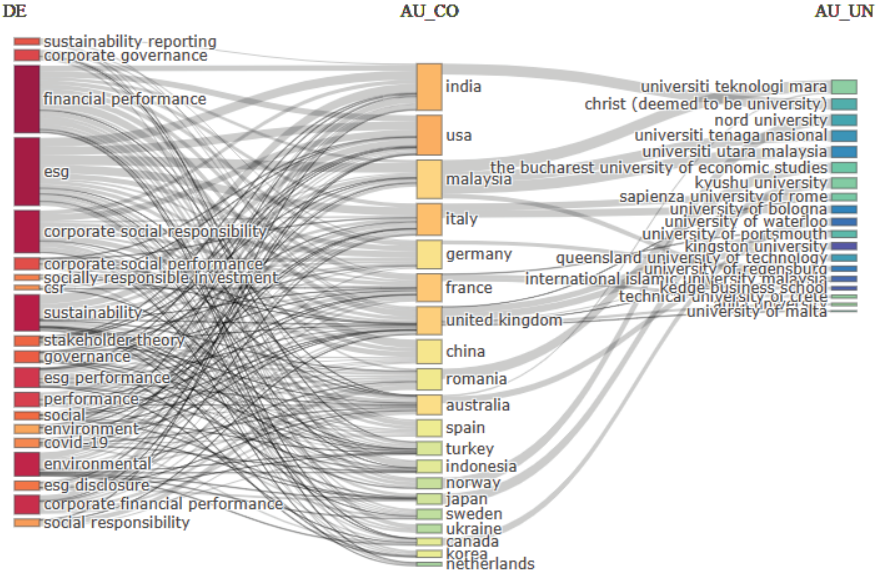

Figure 4. Three-field analysis of "ESG" OR "environment*, social, and governance" OR "Sustainab*" OR "social responsible invest*" OR "impact invest*" OR "ethic* invest*" AND "financial performance" OR "portfolio performance".

3. Influential Aspects of ESG, SRI, Impact Investing, and Ethical Investing

3.1. Core Journals

The source impact and Bradford's Law were employed to identify the most important journals that publish the ESG, SRI, ethical investing, impact investing, and performance literature. According to Table 2, the Bradford rule categorises the journal into three zones. Zone 1, also known as a nuclear zone, is immensely valuable. Opposed to Zone 1, Zone 2 is slightly more productive. According to Bradford's rule in Zone 1, the top-ranked journal is *Sustainability* (Switzerland), which has published 215 articles on ESG, SRI, impact investing, and ethical investing. Table 3 displays the ranks of publications based on the h-index,

m-index, and g-index, total citations, net publications (NP), and the publication year (PY start). Ad-ditionally, top affiliations are indicated based on the frequency of publication and cita-tions.

Table 2. Journal Rankings.

Sources	Rank	Freq	cumFreq	Zone
Business Strategy and The Environment	1	11	11	Zone 1
Journal of Cleaner Production	2	8	19	Zone 1
Journal of Sustainable Finance and Investment	3	8	27	Zone 1
Journal of Business Ethics	4	7	34	Zone 1
Social Responsibility Journal	5	6	40	Zone 1
Corporate Social Responsibility and Environmental Management	6	5	45	Zone 1
Critical Studies on Corporate Responsibility, Governance and Sustainability	7	5	50	Zone 1
Borsa Istanbul Review	8	4	54	Zone 1
Finance Research Letters	9	4	58	Zone 1
Journal of Asset Management	10	4	62	Zone 1
Journal of Business Research	11	4	66	Zone 1
Journal of Global Responsibility	12	4	70	Zone 1
Australasian Accounting, Business and Finance Journal	13	3	73	Zone 1
Business Strategy and Development	14	3	76	Zone 1
Environmental, Development and Sustainability	15	3	79	Zone 1
Journal of Business Economics and Management	16	3	82	Zone 1
Journal of Portfolio Management	17	3	85	Zone 1
Review of Financial Economics	18	3	88	Zone 1
Accounting and Finance	19	2	90	Zone 2
Accounting Research Journal	20	2	92	Zone 2

Source: Own elaboration.

Table 3. Top Journal According to Source Impact.

Element	h_index	g_index	m_index	PY_start
Academic Journal of Interdisciplinary Studies	1	1	0.25	2019
Academy of Accounting and Financial Studies Journal	2	2	0.25	2015
Academy of Management Perspectives	1	1	0.10	2013
Accounting	1	1	0.33	2020
Accounting and Business Research	2	2	0.29	2016
Accounting and Finance	2	2	0.40	2018
Accounting Perspectives	1	1	0.20	2018
Accounting Research Journal	2	3	0.29	2016
Accounting, Auditing and Accountability Journal	3	3	0.75	2019
Administrative Management Public	2	2	0.25	2015
Administrative Sciences	2	2	0.40	2018
Advanced Science Letters	1	1	0.13	2015
Advances In Accounting	1	1	0.14	2016
African Journal of Economic and Management Studies	1	1	0.13	2015
African Journal of Hospitality, Tourism and Leisure	1	1	0.25	2019
Agricultural And Resource Economics	1	1	0.50	2021
Agricultural Economics (Czech Republic)	1	1	0.50	2021
Agricultural Finance Review	1	1	0.33	2020
Agroecology And Sustainable Food Systems	1	1	0.20	2018
Al-Shajarah	1	1	0.25	2019

Source: Own Elaboration.

Figure 5 depicts the increase in publishing by leading journals. A downward trend was observed between 2013 and 2015. A significant surge in publications linked to ESG, SRI, impact investment, and ethical investing has been shown since 2016. After 2016, there was an increase in the number of articles in *Sustainability*, *Journal of Cleaner Production*, and *Business Strategy and Environment*.

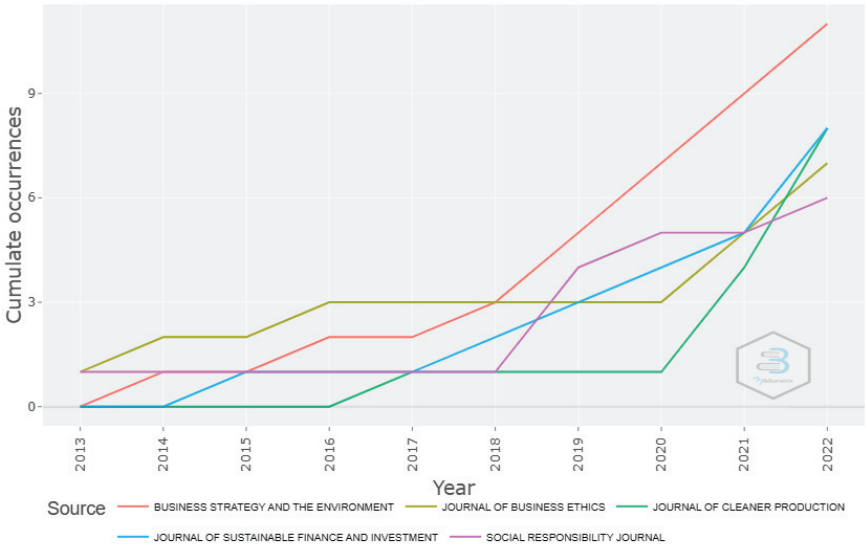

Figure 5. Source Growth.

3.2. Core Journal Articles

This section highlights the top articles in ESG, SRI, ethical investing, impact investing, and performance journals. Table 4 lists the top twenty most-cited articles on the subject globally. In the first research, Saeidi et al. (2015) published the most referenced paper with 640 citations. They explored the direct association between CSR and business performance and three likely mediators in the relationship between CSR and firm performance. They discovered that CSR has a positive influence on business performance since it improves competitive advantage, reputation, and customer happiness. These data imply that CSR might indirectly promote corporate performance by strengthening reputation and competitive advantage while increasing consumer satisfaction. The meta-analysis on ESG criteria and CFP is the second most significant article on the list, with 478 citations. Friede et al. (2015) conducted a meta-analysis of over 2000 empirical research on ESG parameters and CFP. The results demonstrate that the business case for ESG investment is empirically sound. Around 90% of research discovers a non-negative ESG–CFP relationship. Most significantly, most of the research indicates good results.

Table 4. Most Globally Cited Article.

No	Paper	Total Citations	TC per Year
1.	How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction.	640	80
2.	ESG and financial performance: aggregated evidence from more than 2000 empirical studies.	478	59.7
3.	Corporate social responsibility in the banking industry: Motives and financial performance.	302	30.2
4.	The long-term benefits of organizational resilience through sustainable business practices.	247	35.3
5.	The Role and Impact of Industry 4.0 and the Internet of Things on the Business Strategy of the Value Chain—The Case of Hungary.	219	43.8
6.	Explanatory Factors of Integrated Sustainability and Financial Reporting.	217	24.1
7.	"Greening" the marketing mix: do firms do it and does it pay off?	217	21.7
8.	Instrumental and Integrative Logics in Business Sustainability.	208	20.8

Table 4. *Cont.*

No	Paper	Total Citations	TC per Year
9.	Green Innovation and Financial Performance: An Institutional Approach.	198	19.8
10.	A reverse logistics social responsibility evaluation framework based on the triple bottom line approach.	190	19
11.	Financial performance of socially responsible investing (SRI): what have we learned? A meta-analysis.	184	23
12.	Green supply chain performance measurement using fuzzy ANP-based balanced scorecard: a collaborative decision-making approach.	175	19.4
13.	Proactive CSR: An Empirical Analysis of the Role of its Economic, Social and Environmental Dimensions on the Association between Capabilities and Performance.	175	17.5
14.	The cultural system and integrated reporting.	174	17.4
15.	Why Do Investors Hold Socially Responsible Mutual Funds?	171	28.5
16.	Corporate social responsibility governance, outcomes, and financial performance.	171	28.5
17.	Too Little or too much? Exploring U-shaped Relationships between Corporate Environmental Performance and Corporate Financial Performance.	171	28.5
18.	Corporate social responsibility and financial performance: A non-linear and disaggregated approach.	165	23.6
19.	The Relationship between Women Directors and Corporate Social Responsibility.	164	20.5
20.	Corporate social responsibility research in accounting.	163	20.4

Source: Extracted from SCOPUS.

3.3. Core Words

The most used terms in the ESG, SRI, impact investing, and ethical investing literature are stated in Table 5. The authors' most frequent keywords include "financial performance", "ESG", "corporate social responsibility" and "sustainability", having the highest occurrence of 70 times.

Table 5. Most-frequent words.

Author's Keywords	Occurrences
Financial performance	70
ESG	63
Corporate social responsibility	44
Sustainability	37
Environmental	28
Corporate financial performance	23
ESG performance	22
Performance	19
Corporate governance	18
Corporate social performance	12
Sustainability reporting	12
Governance	11
Stakeholder theory	11
Social	10
ESG disclosure	9
Socially responsible investment	9
COVID-19	8
CSR	8
Social responsibility	8
Environment	7

Source: Own elaboration.

Figure 6 depicts the word cloud created using keyword addition. Words that often recur in the text have greater font sizes. In the literature on ESG, SRI, impact investing, and

ethical investing, the terms "financial performance", "finance", "financial system", and "industrial performance" appear most often. Consequently, these terms are the most often used terms, followed by stakeholders, environmental management, governance approach, supply chain management, stakeholders, and profitability.

Figure 6. Word cloud.

In addition to the word cloud, Figure 7 displays the evolution of terms in literature across time. As seen in the graph, the term "sustainability" started to grow in popularity in 2016. The keyword "sustainable development" has also been on the rise since 2016. Figure 6 shows how keywords evolve over time using a lowess smoothing approach. There was a significant increase in industry-related issues in 2017.

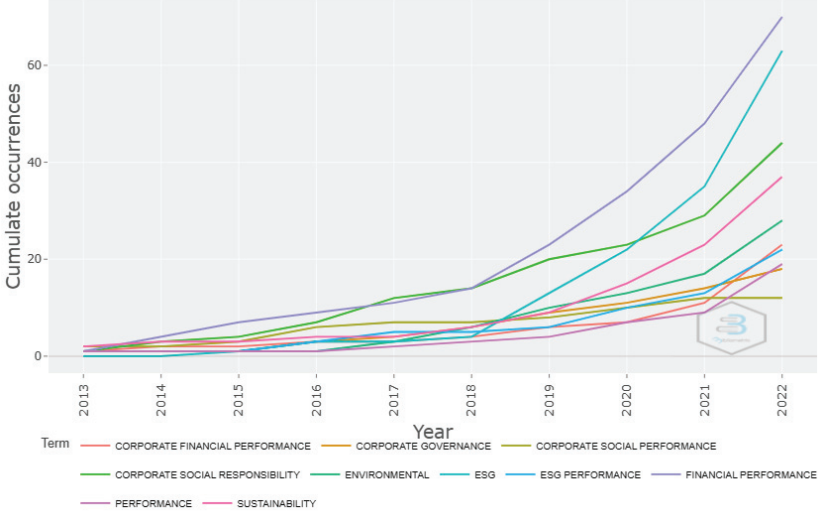

Figure 7. Word growth over time.

4. Conceptual Framework

4.1. Co-Occurrence Network

Figure 8 depicts the co-occurrence network of the authors' terms. The illustration is from the R package 'biblioshiny' ('bibliometrix'). The keyword co-occurrence network exposes three separate streams of ESG, SRI, impact investing, and ethical investing and categorises this literature into three different clusters: green, red, and blue.

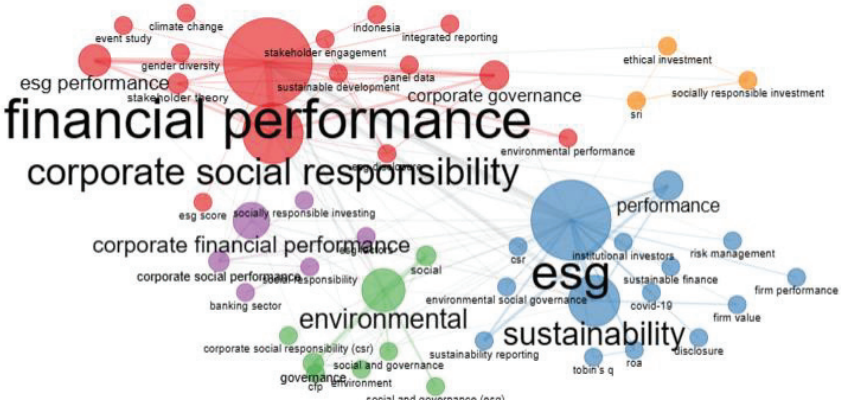

Figure 8. Co-occurrence network.

The red and purple cluster focuses on the following research areas: the impact of sustainability on firm performance, including environmental performance, social performance, environmental sustainability, and sustainable development. According to the corporate perspective, companies that place a high value on ESG and perform well outperform their rivals in ESG risk management. In addition, organisations that do well in ESG have a long-term and consistent positive association between ESG performance and financial success. In developing countries, ESG investing techniques might provide large excess profits. Numerous studies in this cluster have investigated environmental performance and its impact on European listed firms' financial performance (Wamba 2022), Serbia (Hanić et al. 2021), and China (Chang et al. 2021). Friede et al. (2015) reviewed over 2200 relevant papers and discovered that over 2100 empirical studies (particularly company-centric empirical studies) demonstrated a favourable association between ESG and CFP.

The blue cluster's issues were on ESG, such as ESG reporting, sustainability reporting, integrated reporting, stakeholder engagement, sustainability performance, company value, and governance. The disclosure of environmental, social responsibility, and corporate governance (environment, social, and governance, or ESG) information is referred to as ESG disclosure. Businesses have made efforts towards internal improvement by implementing sustainable and socially responsible policies and reporting them in order to stay competitive, as the demands for corporate transparency and accountability for ESG reporting have increased dramatically over the last few decades. In addition to non-financial reporting, corporate sustainability reports (CSR), CSR disclosures (CSRD), and economic, governance, social, ethical, and environmental (EGSEE) reports have all been used to express the idea of ESG reporting (Rezaee 2016). ESG factors are increasingly a crucial component of many finance providers' investment decisions. Sustainable investing ideas have already been implemented by several conventional fund managers (Van Duuren et al. 2016). Besides financial performances, ESG performances are one of the important factors that effectively can encourage investors.

The green cluster focuses on the study of CSR, which includes the social, financial, and environmental aspects of company performance and corporate governance. In fact, CSR and ESG vary from one another in a few ways. Accordingly, CSR prioritises the needs

of a variety of stakeholders and organisations, and ESG has emerged as a crucial tenet of CSR (Gao et al. 2021). Primarily, ESG begins from the viewpoint of capital market investors, concentrating on the connection between corporate social performance and shareholder returns (Gao et al. 2021). The ESG application scenarios concentrate on the capital market, particularly between investors and listed firms. In contrast, CSR application scenarios are rather wide and may emerge in sectors including company supply chain management, brand marketing, community communication, and employee management (Gao et al. 2021).

4.2. Thematic Map

This research has defined a few study topics to help readers comprehend the results. The developed themes can be integrated into a strategic diagram to assess the importance and conception of the study subject. The analysis of the thematic map in this research offered valuable insights into the trends and patterns within the literature on ESG, SRI, ethical, and impact investing. By examining the centrality and density of different themes, the study identified the varying degrees of importance, development, and relevance of these themes within the field. Figure 9 displays the thematic map based on density (y-axis) and centrality (x-axis). The centrality of the selected theme is a gauge of its importance. In contrast, the density of the selected subject is used to gauge its development. Furthermore, the subject's relevance within the broader field of inquiry may be inferred from its centrality, and the subject's development can be gauged from its density. The author's keywords are those that the original authors gave at the time the text was published. It is possible to draw attention to the many themes within a specific area by using the clustering method on the term network. A strategic or thematic map is a specific plot that may show each cluster or topic.

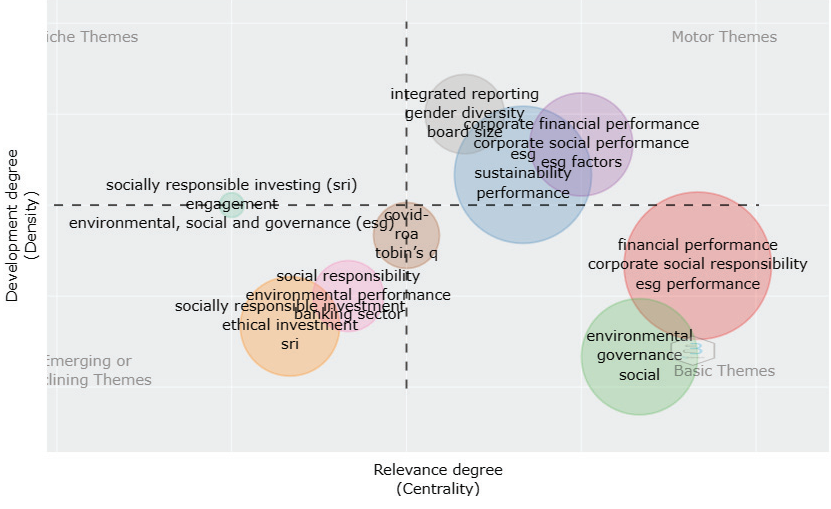

Figure 9. Thematic map.

There are four sections to the graph. Themes that appear in the lower left corner are those that are emerging or waning. These fresh ideas can emerge and advance the subject of study, or they might disappear. The thematic map's bottom right corner contains the fundamental or transversal topics. Although having a modest density, these motifs are immensely important. Based on the information provided, the ideas of corporate financial performance, corporate social performance, ESG, and ESG factors are located in the top right corner of the thematic map, which is known as the motor theme. This suggests that these topics have received significant attention and have been extensively studied in the context of ESG, SRI, ethical, and impact investing. Researchers can further explore

these themes to gain deeper insights into their relationship with financial and portfolio performance. Socially responsible investment (SRI), engagement, and ESG are in the upper left corner of the thematic map called the niche theme, representing the well-developed concepts in the literature on ESG, SRI, and ethical and impact investing and performance. These themes have received considerable attention and have been extensively explored within the specific context of ESG, SRI, and ethical and impact investing. Researchers can delve into these areas to investigate the effectiveness of engagement strategies or the impact of ESG practices on company performance.

The terms "socially responsible investment", "ethical investment", "environmental performance", and "SRI" may be found in the lower left corner under the heading "highly developed topic/emerging or decreasing theme". While these themes have been extensively studied in the past, their decreasing density suggests a potential shift in research focus or emerging interest in other areas. Researchers can explore the reasons behind these trends and investigate the evolving dynamics within these themes. Financial performance, corporate social responsibility, ESG performance, and environmental, social, and governance in the sustainability literature are the less-developed and basic concepts present in the lower right corner named "basic or transversal theme". These themes exhibited lower centrality and density, indicating the need for further research and development. Researchers can focus on exploring the integration of ESG considerations into investment decision-making processes or assessing the long-term implications of environmental and social factors on financial performance. More study on these topics in the particular situation described by the fundamental theme is required to bring value to this subject. Difficulties that are in a hybrid situation, such as two quadrants, may also be detected. They are socially responsible investing, engagement, and ESG, which imply a position between niche themes and highly developed topic/emerging or decreasing theme, while the impact of COVID-19 on sustainability and financial performance such as Return on Assets (ROA), and Tobin's Q imply a position between highly developed topic/emerging or decreasing theme and basic theme.

4.3. Thematic Evolution

Thematic evolution (Figure 10) displays the history of the literature through time and the theme diagram. Keywords and thematic evolution are used to show the history and development of themes. Thematic development is accomplished by the usage of 'biblioshiny' and the division of thematic evolution into two sections. The first portion ranges from 2013 to 2019. The first phase of this research focused on the impact of sustainability and ESG on financial performance and company financial performance. The performances of sustainability, ESG, and productivity have been given enormous weightage in the final time segment covering 2021 to 2022 in the sustainability disclosure literature.

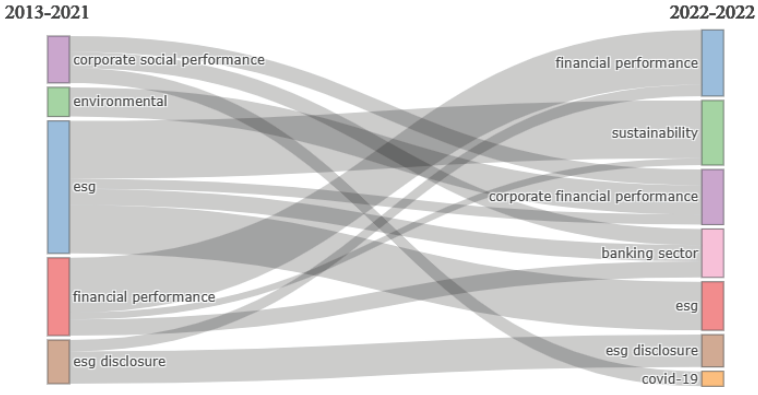

Figure 10. Thematic evolution.

5. Discussions and Future Research Directions

The present study offers numerous insights into ESG, SRI, ethical and impact investing, and performance literature. Initially, in response to the research question, the following influential factors were discovered:

(1) The recent years, 2021–2022, had the largest number of publications. The findings suggest that ESG, SRI, ethical investing, impact investing, and performance literature remain a potential concern for ESG, SRI, ethical investing, and impact investing scholars seeking additional study contributions.

(2) *Business Strategy and the Environment*, *Journal of Cleaner Production*, and *Journal of Sustainable Finance and Investment* are the primary avenues for publishing additional studies on this topic.

(3) The most significant articles on this subject were recognised as Saeidi et al. (2015) and Friede et al. (2015). According to Saeidi et al. (2015), the link between CSR and firm performance is more complicated than prior research has demonstrated. As a result, the neglected sustainable competitive advantage as a result of customer happiness and reputation is thought to be another effective mediator in the relationship. Friede et al. (2015) examined over 2200 independent studies on the ESG–CFP link. According to the findings, 90% of research reveals a non-negative ESG–CFP relationship. Most significantly, the majority of research indicates good results. The study's recent citations may help the researchers contribute increasingly advanced research in this area.

(4) India is the most active researcher in this subject. Future studies are recommended to undertake further cross-country research using a panel of organisations from high- and low-carbon-emitting nations.

Second, the answers to the second research question on the most typical trends in this area bring up new possibilities for future research. The first trend in ESG, SRI, and ethical and impact investing is financial performance, followed by sustainability and CSR. Nonetheless, earlier research has been confined to a particular context, for instance, in the USA (Wamba 2022), China (Zhang et al. 2022), and Serbia (Hanić et al. 2021). As a result, it is advised that future studies expand this study in cross-country situations with varying economic and political backgrounds. Finally, the results show that new themes are developing, including SRI and social responsibility. Recently, much research has been conducted on ESG and intellectual capital. Future studies will add to these rising cross-national issues and novel research designs.

This study offers valuable practical implications and outlines compelling future research directions for this discipline. Future research can focus on investigating the effectiveness of engagement strategies in driving positive changes in companies' ESG practices. Furthermore, examining the evolving role of global events, such as COVID-19, in shaping the relationships between ESG, SRI, ethical and impact investing, and financial performance offers opportunities for deeper insights. Assessing the long-term implications of gender diversity and board size on company performance and sustainability presents another area of research that holds significant potential. Additionally, studying the integration of ESG considerations into investment decision-making processes and comprehending its impact on portfolio performance can provide valuable insights into more effective and sustainable investment practices. By pursuing these future research avenues, scholars can advance their understanding of ESG, SRI, ethical, and impact investing, ultimately fostering the development of enhanced frameworks and strategies that promote more sustainable and responsible investment practices in the future.

There are several limitations to this study that should be considered. Firstly, the study relied solely on data obtained from the SCOPUS database, potentially limiting the breadth and depth of the literature review. In future research, it is recommended to extract bibliographic information from additional databases, such as WOS (Web of Science), to ensure a more comprehensive analysis. Secondly, the presence of comparable duplicate data, including variations in keywords (e.g., singular/plural forms) and the usage of hyphens within compound words, may have compromised the validity of the findings. To

address this, future researchers should employ diverse retrieval techniques and conduct more refined and relevant searches to mitigate duplicate data and improve data accuracy.

Furthermore, the study's analysis focused on mapping and clustering techniques. Although these approaches provided insights into emerging themes, there is a possibility that additional connections and sub-themes could have been overlooked. Future studies should consider employing network analysis techniques, such as term co-occurrence and bibliographical coupling, with looser threshold settings to uncover additional connections and explore further research avenues. By considering these limitations, future research can expand upon the findings of this study by incorporating data from multiple databases, employing more refined search strategies, and utilising diverse analytical approaches to enhance the understanding of the field and identify additional prospective areas of research.

6. Conclusions

The major goal of this research is to emphasise the contributions made by academics in the fields of ESG, SRI, ethical investing, and impact investing. This research has specifically highlighted the significant factors, current trends, and major topics using bibliometric analysis of 262 papers from 2013 to 2022. This analysis identified the top journals, authors, nations, keywords, and most significant papers on this subject as some of the influencing factors. The thematic map classified the ESG, SRI, and performance relationship themes into four categories of themes: niche themes (SRI, engagement and ESG), motor themes (corporate financial performance, corporate social performance, ESG, ESG factors, sustainability, performance, integrated reporting, gender diversity, and board size), emerging or declining themes (social responsibility, environmental performance, socially responsible investment, ethical investment, and SRI), and basic or transversal themes (financial performance, corporate social performance, ESG performance, environmental, social, and governance). Socially responsible investing, engagement, and ESG imply a position between niche themes and a highly developed topic/emerging or decreasing theme, while the impact of COVID-19 on sustainability and financial performance implies a position between highly developed topic/emerging or decreasing theme and basic theme. Based on the research results, this study has offered implications and suggestions for further research. The main trends in the link between performance and ESG, SRI, ethical, and impact investing are presented in this systematic and bibliometric study. Nevertheless, the study has brought to light several contractionary results in the chosen papers that might be efficiently addressed by this field's meta-analysis. In conclusion, the study's findings highlight the importance of considering ESG, SRI, ethical investing, and impact investing in order to enhance financial and portfolio performance. By integrating ESG factors and actively engaging with companies, managers can make more informed investment decisions, mitigate risks, and seize opportunities for sustainable growth. Policymakers and legislators can support these efforts by promoting regulatory frameworks that incentivize responsible investment practices and encourage transparency in ESG reporting. Ultimately, by embracing the principles of sustainability and responsible investing, stakeholders can contribute to the development of a more efficient and resilient capital market, fostering long-term financial and portfolio performance.

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Data Availability Statement: This study employed the published studies' publicly available meta-data.

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

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Review

Selected Problems of the Automotive Industry—Material and Economic Risk

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Abstract: This article is a synthetic, brief review of the literature, reports and references on the transformation of the automotive industry into zero-emission cars, in particular electric cars. It analyzes the technological and economic aspects of changes in the automotive industry regarding the transformation to zero-emission cars. Despite great de-emission parameters, the production of electric cars does not have a zero carbon footprint. The acquisition of critical elements, their production and the production of other components and materials needed for their construction have an environmental impact. The supply chains of materials for the construction of batteries for electric cars are characterized by significant risks related to, among others, a lack of diversification and limited flexibility. The dominant supplier of rare elements for batteries is China. The article analyzes the impact of prices on the demand for electric cars and compares them to internal combustion cars. Research shows that most electric cars are sold in China, the USA and Europe (about 95% of the supply). The costs of cars are of great importance, which, given the current reduction in the purchasing power of consumers, make the forecasts of the dynamic growth of electromobility very cautious, and even stagnation in the purchase of electric cars is expected in the second half of 2023.

Keywords: electromobility risk; rare metals; environmental protection; costs of automotive transformation

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1. Introduction

Currently, there are more and more changes in the automotive market focused on the production of zero-emission cars. Changes in the automotive industry push the limits of possible solutions in autonomous cars, introduce innovative, based on advanced electronics, car maintenance and servicing solutions. In particular, they concern the introduction of electric drive to cars, which is related to the demand for light metals, rare metals, graphite. Environmental regulations, as well as consumer awareness of the ongoing global climate change, are increasing the demand for electric cars (EVs). The barriers that stand in the way of widespread electric motorization are the price of the car and poor electric charging infrastructure. The use of electric cars is also not synonymous with a complete lack of environmental impact. An assessment shows that charging electric cars does not necessarily reduce the carbon footprint if the energy does not come from renewable sources. It was also found that every kilometer traveled by an electric vehicle produces 35–50 times more sulfur oxides than a conventional vehicle (Liu et al. 2012). It was found that the high weight of electric cars causes more wear on the rubber treads of the wheels and, consequently, more contamination with rubber particles. Extraction and production of materials for the construction of electric cars and their batteries is a source of environmental pollution. The carbon footprint of electric-car production is therefore not zero. Despite these reservations, so far no alternative solutions have gained significant market popularity. There are reports of using hydrogen to power vehicles. However, this possibility does not translate into widespread use. Electric motoring is a megatrend. The problems of electric motoring are primarily related to the availability and prices of battery materials that require elements

such as lithium, cobalt, magnesium, nickel and graphite. Mining of these elements is concentrated in few countries in the world, which introduces risk in supply chains. Since most of the production and processing of materials for electric-car batteries is carried out in China, there is a risk of dependence on this country (Altenburg et al. 2022). There is also a problem with the appropriate number of vehicle-charging stations (Canizes et al. 2019; The Global Electric Vehicle Market Overview 2023). This article briefly presents the main issues related to the risks related to the production of electric-car batteries. The research problem boils down to assessing the risk of supplies of materials necessary for the production of batteries for electric cars. They are the most critical element of the car in terms of material and cost. Materials for the construction of batteries for electric cars are sourced in several countries around the world, and most of the components are produced in China. There is a need to analyze the possibilities of supply diversification, as well as assess the risk related to the narrow scope of flexibility of supply chains on the one hand, and their widespread globalization on the other. The prices of materials for the construction of batteries affect the prices of electric cars and the purchasing power of consumers. What are the prospects for implementing the idea of a complete transition to zero-emission cars? This will probably depend primarily on advances in material solutions for the construction of batteries for electric cars. The aim of the article is to search for an answer to the question to what extent the demand for materials for the construction of electric batteries and the risk associated with the threats in their supply affect changes in the automotive industry.

The article was built from a literature review; it analyzes the technological and economical aspects of the automotive market, with particular emphasis on the issues of electric motorization. The article is organized as follows: after the Introduction, there is a Section 2 entitled "Trends in Car Production", which briefly presents the development trends in the automotive industry. The Section 3 "Impact of motorization on the environment" informs about car emission. Then the Section 4 "Risk of Electric-Car Supply Chains" presents the problems of obtaining materials for electric-car batteries, in the next Section 5 "The Impact of Costs on the Demand for Electric Cars" the costs of electric cars are assessed and compared to the price of classic cars powered by internal-combustion engines. The next Section 6 of the article is the "Discussion", in which a short analysis of the data obtained from the literature review is carried out and possible directions for further pro-ecological activities in the field of the automotive industry are indicated. "Conclusions" (Section 7) presents a synthetic summary of the most important issues of the current automotive industry.

2. Trends in Car Production

From January to May 2023, the EU car market grew by 18%, to 4.4 million registered cars. Although the market improved in May, year-to-date sales are still 23% lower compared to the same month in 2019, when 5.7 million units were registered. In this five-month period, there were double-digit gains in most markets, including the four largest: Spain (+26.9%), Italy (+26.1%), France (+16.3%) and Germany (+10.2%). In May, the share of the battery electric-car market recorded a significant increase from 9.6% to 13.8%. Hybrid electric cars are now the second-most popular choice for new-car buyers, accounting for almost a quarter of the market. However, petrol cars still have the largest share at 36.5%. (Cuenot and Fulton 2011; Automotive Trends Report 2023). The bulk of electric-car sales has been predominantly concentrated in three major markets: China, Europe and the United States. China totally dominated the electric-car market, making up 60% of global sales (Melissa 2023; Chu and Cui 2023). Czechia, Slovakia and Poland were the largest vehicle producers in 2020 (Pavlínek 2023). COVID-19 ripple effects, including the shortages of semiconductors, continued to negatively affect car production in 2021 and 2022. The 2022 production was also negatively affected by the war in Ukraine. Current trends in the automotive industry generate regulatory and competitive pressures on European carmakers to adopt electric-car technology. Despite government messages about the need to address climate change, the transition to electric cars is mainly due to convincing consumers that their use will significantly reduce car-operating costs (Deloitte 2023). The price of an

average new car increased by about 27 percent between 2012 and 2021. This trend will probably persist. Rising car prices coupled with declining consumer purchasing power may limit car sales (Global Strategy Group 2023). However the global automotive finance market is projected to grow from USD 245.62 billion in 2021 to USD 385.42 billion by 2028. The market is expected to grow at Compound Annual Growth Rate of 6.5% (Fortune Business Insights 2023). The automotive industry is a major industrial and economic force in several economies. More recently, China has become a leader in the industry, particularly with regard to the production of electric cars (Electric Vehicle). The automotive industry consists of complex supply chains, which over time have evolved into a global production network (Deloitte 2023; Frigant and Zumpe 2014). While only a limited number of countries and companies lead the production of automobiles, the industry's value chain is spread all over the globe and a large number of companies are involved in designing, developing, manufacturing, marketing, selling, repairing and servicing automobiles and automobile components (ILO 2021). On average, each car contains more than 20,000 parts, which original equipment manufacturers (original equipment manufacturer) source from thousands of different suppliers (Kapadia 2018).

China remains the world's largest electric-car market (IEA 2023a). In 2022, 6.2 million electric cars were sold in the country; that was an 82% increase from 2021, and China's sales represented 59% of the global total. Europe as a single market sold 2.7 million EVs in 2022, a 15% increase from 2021 and 25% of the global total. With 994,000 EV sales in 2022, the United States resumed its place as the second-largest national electric-car market, after briefly being supplanted by Germany in 2020 and 2021; 2022 sales were up 50% from the previous year and represented 9.3% of the global total. Rounding out the top five national electric cars markets in 2022 were Germany (845,000), the United Kingdom (386,000) and France (344,000) (Figure 1). Japan hit an all-time high in electric-car sales of 92,000 in 2022, a 109% increase over the previous year, and improved its ranking from 17th in 2021 to 13th in 2022. Nascent markets in Southeast and South Asia grew their electric-car sales in the year. For example, Indonesia, India and Thailand recorded 10,000, 51,000 and 21,000 in 2022 sales, respectively, increases of 1,100%, 210% and 130% from 2021 (Figure 1). The Association of Southeast Asian Nations (ASEAN) as a single market sold 39,000 electric cars in 2022, a 165% increase from the previous year.

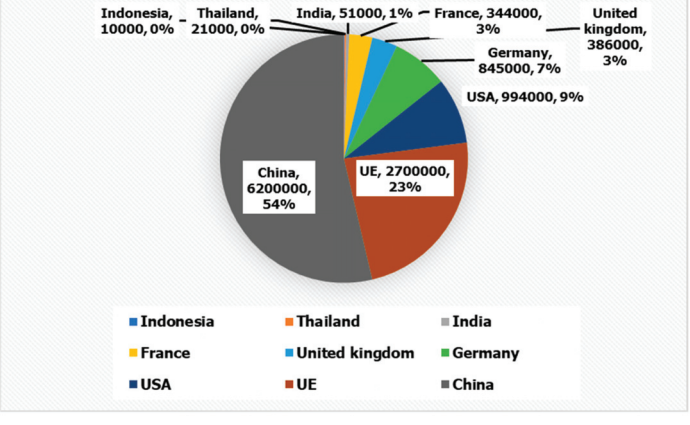

Figure 1. Electric-car sales market.

3. Impact of Motorization on the Environment

The automotive industry is under immense pressure, both from governments and consumers, to improve the environmental sustainability of the production and use of vehicles. The transport sector is the fastest-growing contributor to greenhouse-gas emissions, accounting for 24% of CO_2 emissions and approximately 14% of total GHG emissions.

Road transport—including cars, trucks, buses and two- and three-wheelers—is in turn responsible for about 75% of overall transport emissions (IEA 2019). The transportation sector generates the largest share of greenhouse-gas emissions. Greenhouse-gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains and planes (St. John 2022). Over 94% of the fuel used for transportation is petroleum-based, primarily gasoline and diesel (EPA 2023). Transformations of the automotive market towards environmental protection focus on such proposals as the production of electric cars (Celasun et al. 2023) or hydrogen-powered cars. Overall vehicle trends are influenced by both vehicle technology and design as well as changes in the distribution of manufactured vehicles (OICA 2023). For a specific vehicle, increased weight or power may result in higher CO_2 emissions and lower fuel consumption, all other factors being equal. Larger vehicles, in this case measured by the area taken up by four tires, also have higher CO_2 emissions and lower fuel consumption. The carbon footprint is the basis for setting regulatory standards under the greenhouse gas and Corporate Average Fuel Economy regulations. Electric vehicles do not emit exhaust fumes from the tailpipe; however, vehicle weight, horsepower and size can still affect a vehicle's fuel economy (measured in miles per gallon of gasoline equivalent). Fuel consumption has increased for all types of vehicles since 2008. However, improvements in technology have shifted the market towards fuel economy and reduced CO_2 emissions (Automotive Trends Report 2023).

Analyses in this work revealed that the electric car, regardless of the road conditions, achieved lower carbon-dioxide emissions, in the range of 10–65%, compared to the car with a combustion engine (Kubik et al. 2023). Also, the authors of the paper (Grzesiak and Sulich 2022) found a higher emissivity of gasoline-powered cars than electric cars while driving.

On the other hand, investigation of the whole footprint shows that there was not much difference in carbon-dioxide emissions in the production phase of electric and combustion vehicles. The differences are due to the presence of batteries in electric cars and the place of production (Neugebauer et al. 2022). The CO_2 emissions associated with an electric cars depend on the energy sources used to power its batteries, which depend on the place of use, with different operating emissions. All variants have been adopted for a car lifetime of 150,000 km, as driving more miles with an electric car would require battery replacement, resulting in a significant increase in cumulative CO_2 emissions over the vehicle's life cycle. At the stage of production of the "body" of the engine and drive, there are no differences in the level of CO_2 emissions for both analyzed car models. The biggest differences are in the production of batteries: 6337 and 19.5 kg-CO_2 for electric and internal combustion cars, respectively. Similarly, at the disposal stage, the disposal of an electric car is associated with more than 1900 kg of CO_2 emissions. This is mainly due to the high CO_2 emissions associated with battery disposal. In turn, the annual maintenance of both vehicles generates comparable CO_2 emissions. However, the type of power source has the greatest impact on the ecological use of an electric car in relation to a combustion engine. In the case of the variant, electricity from photovoltaics or wind, the cumulative CO_2 emission for an electric car is more than twice lower than for a combustion vehicle. The results obtained in the work (Neugebauer et al. 2022) are completely different from those given in (Teixeira and Sodré 2018; Kubik et al. 2023; Grzesiak and Sulich 2022), where the authors showed that the replacement of internal-combustion engines with electric cars is always beneficial from the point of view of CO_2 emissions. This is only true when the emissions related to driving the car itself are taken into account; however, when emissions (especially) in the production and operation phases are taken into account, unfortunately the conclusion is exactly the opposite. This indicates that only a complete change of habits at every stage of car production and use can help reduce CO_2 emissions and fight global warming.

4. Risk of Electric-Car Supply Chains

The basic elements regarding the development of the automotive industry are light metals, rare metals and graphite (Barman et al. 2023). The sources of these materials are a few countries, which means that their availability is limited and the risk of supply is

high. This has a significant impact on the supply chains for the production of batteries and electric cars themselves (Racu 2023).

The following materials are needed to make an electric-vehicle battery (share and absolute amount) (Ragonnaud 2023): aluminium (126 kg—32%), graphit (71 kg—18%), nickel (41 kg—10%), electrolyte (37 kg—9%), copper (22 kg—6%), plastic (21 kg—5%), manganese (12 kg—3%), cobalt (9 kg—2%), electronics (9 kg—2%), lithium (8 kg—2%), steel (3 kg—1%), residual (41 kg—10%) (Figure 2).

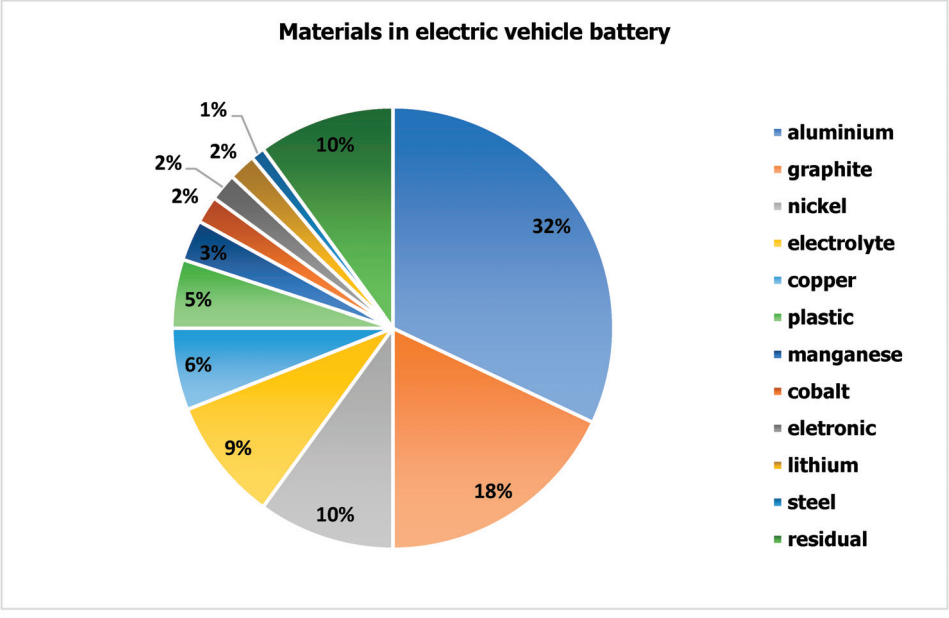

Figure 2. Materials to electric battery.

Lithium-ion batteries and electric arc furnace (EAF) electrodes are used in the metallurgy. In 2021, China remained the world's largest producer of natural graphite, with a global market share of 79% (Ritoe et al. 2022). In 2022, the lithium-ion battery anode market became the largest end-use market for natural flake graphite.

Australia has a dominant position in the global lithium market. In 2022, Australia supplied 79% of the world's lithium—a hard concentrate of spodumene—and secured 53% of the global supply of lithium (Pollard 2023). In 2022 Australia produced 61,000 tons of lithum. China dominates Australia's customer base and imported 96% of the total lithium in 2021/22. The second and third importers of Australian lithium were Belgium (2.3%) and South Korea (0.9%).

Chile is the second largest producer of lithium in the world (30,000 in 2022); next are China 19,000, Argentina 6200, Zimbabwe 800 tons, Portugal 600, Canada 500 tons and others 700 tons (Venditti and Parker 2023). Chile is the world's largest lithium producer from brines, and the second largest producer overall after Australia, which produces lithium from rock. Chile's lithium production comes from just one source: the Salar de Atacama in the north, home to the one of largest lithium reserves in the world, 9.2 million tons. Chile produced almost 30% of global output in 2021, or 26,000 tons. But its sector is dominated by just two companies, with no new projects on the horizon (Vásquez 2023). Argentina is the fourth-largest lithium-producing country in the world after Australia, Chile and China. In 2021, Argentina produced 6200 tons of lithium. That was just a little more than a fourth of Chile's output.

The larges lithium reserves are in Bolivia (23 Mt), Argentina (20 Mt), the USA (12 Mt), Chile (11 Mt), Australia (7.0 Mt) and China 6.8 Mt) (Venditti and Parker 2023). As the world increases its production of batteries and electric vehicles, the demand for lithium is projected to soar. Lithium is one of the richest resources on earth, but economically viable deposits are concentrated in only a few regions. In some cases, it is difficult or impossible to free lithium from the minerals associated with it (Donnely 2023). Li-ion batteries accounted for 27% of total lithium consumption in 2010 and this number can only be expected to increase as electric and hybrid vehicles become more mainstream (Keller and Anderson 2018). Mining costs are of great importance, as they concentrate viable lithium mining in a few countries. The lithium-mining market is narrowed down to the major players, which are mainly based in Australia, Chile and Argentina, and are key lithium producers (Paulet 2023). This involves the risk of supply chains with the exponential growth in demand for lithium for electric-car batteries.

Graphite is used in various industries such as automotive, metallurgy, nuclear industry, powder metallurgy, fuel cells, flame retardants and others. This wide application is the result of many different, beneficial properties of graphite (Ritoe et al. 2022). There are two types of graphite: natural and synthetic graphite. The supply of synthetic graphite is lower than that of natural graphite. Synthetic graphite is made from petroleum or coal-based needle coke. Synthetic graphite is preferred for production of electric arc furnaces (EAFs) and steel. Battery manufacturers, on the other hand, can benefit both synthetic and natural graphite. The processing of natural graphite is becoming more and more popular due to new and sustainable methods, production processes and production capabilities outside of China in countries such as Mozambique, Ukraine and Norway. Graphite is a key mineral for the energy transition, contributing to clean technology solutions. Global demand for graphite could increase by up to 500% by 2050 compared to 2018 levels. Most of this demand comes from two industries: This application is ahead of other traditional uses of graphite in the refractory and foundry industries. Hence, graphite prices are expected to be controlled by the battery market (Miller 2023). There is a deficit in the supply of natural graphite raw material, forcing more producers to use synthetic graphite. The battery graphite supply chain is currently most dependent on China. Currently, the production of graphite, both natural and synthetic, is concentrated in China. China is estimated to cover approximately 61% of demand for synthetic graphite. Graphite mines exist in many places around the world. However, 100% of graphite is now shipped to China and processed there for anode materials for batteries (Lalli 2021). It should be emphasized that the supplies of flake graphite for electric-car batteries are completely dependent on Chinese production. This involves the monopolization of supplies and the risk of supply chains for the automotive industry.

Raport U.S. Department of Energy Critical Materials Assessment, 2023 placed graphite in the group of critical materials. The report contains a risk matrix of supply risk versus importance to energy (USGS 2023). The report assigns materials to three groups: available materials—phosphorus, titanium, manganese and tellurium; close to critical materials—copper, silicon, electrical steel, uranium, aluminium and fluorine; and critical materials—lithium, nickel, cobalt, graphite, gallium, platinum, magnesium, silicon carbide, dysprosium, iridium, neodymium and praseodymium (Figure 3).

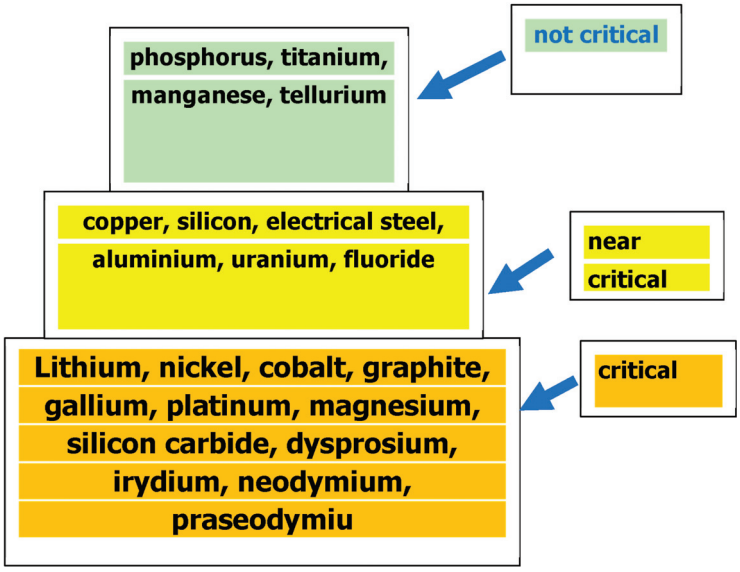

Figure 3. Groups of materials used in electric-battery construction.

Demand for cobalt is expected to increase to 350% in 2050, mainly due to the spread of electric mobility. Currently, the EU imports most of the refined cobalt needed for battery production from China and the Democratic Republic of the Congo (DRC) (Liesbet and van Acke 2022). All materials used in electric cars are in the group of almost-critical and critical materials. At the same time, in many cases, these materials depend on imports from China.

Manganese is industrially, economically and strategically vital to the future of the electric-car industry. For two of the three most common types of Li-ion batteries, Nickel Manganese Cobalt (NMC) and Lithium Manganese Oxide (LMO), manganese constitutes between 20% to 61% of the cathode's composition (Batteryjuniors.com 2022). China produces over 90% of the world's high-purity electrolytic manganese metal (HPEMM) and high-purity manganese sulphate monohydrate (HPMSM)—the only ones that can be used in Li-ion battery production (Giyani Corp 2023). High-purity manganese demand is expected to surge by over 900% between 2020 and 2030, with the market facing severe and growing shortages. The USA currently has zero manganese production and is forced to import 100% of its manganese requirements. Furthermore, 90% of the world's production capacity of high-purity manganese sulphate for electric-car batteries is not secure. This means that in the event of supply disruptions caused by, for example, geopolitical tensions, the electric-car battery industry could be at risk.

Disrupted supply chains have been hindering the production of electric cars since the beginning of the pandemic. This has forced manufacturers to change. Mercedes-Benz is switching to cheaper (but less powerful) batteries for smaller electric models, which reduces the range of travel, and investing in cheap lithium mining in California to ensure supplies for EV57 batteries. Tesla sources materials on the basis of contracts around the world, including a long-term supply contract for nickel from Canadian Vale mines (Silberg et al. 2023).

The stability of the supply chains of raw materials for the construction of batteries is expected to worsen despite all the resource projects announced in Europe. This will be a result of the increased demand for critical materials that will increase even more sharply due to the expansion of battery-cell production. The announced expansion of European electric-car production and processing by 2030 will contribute to growth production, but will also lead to even stricter strategic material autonomy (Bünting et al. 2023).

5. The Impact of Costs on the Demand for Electric Cars

More than 50% of the cost of an electric car is the cost of electric batteries (Bünting et al. 2023). The prices of lithium, nickel, magnesium, cobalt and graphite increased strongly in 2022 due to the demand for these elements for the production of batteries for electric cars, the sales of which are increasing.

The effect of increased battery-material prices differed across various battery chemistries, with the strongest increase being observed for Lithium Iron Phosphate (LFP) batteries (over 25%), while Lithium Nickel Manganese Cobalt Oxide (NMC) batteries experienced an increase of less than 15% (IEA 2023b). Due to the role that lithium plays in the construction of batteries, its price significantly affects the final cost of the car. Given that the price of lithium increased at a higher rate than the price of nickel and cobalt, the price of LFP batteries increased more than the price of NMC batteries. Nevertheless, LFP batteries remain cheaper than NCA (lithium ion battery) and NMC in terms of a unit of energy capacity.

The price of batteries also varies across different regions, with China having the lowest prices on average, and the rest of the Asia Pacific region having the highest. This price discrepancy is influenced by the fact that around 65% of battery cells are manufactured in China (IEA 2023b).

Musk has announced his company's plans for the prospect of selling 20 million electric cars by 2030, which would require 1.2 million tons of lithium chemicals, more than the entire market last year (Tesla Charts a Battery-Powered Future 2023). Tesla's LFP batteries are now 30% cheaper than high-nickel NCM and NCA cells. This is due to the recognition of the price market for Benchmark's Lithium Ion Battery Cell Price Assessment. But their production is concentrated in China, creating a geopolitical risk for automakers. Tesla has announced that it will eliminate rare-earth elements from its electric cars. Battery production is becoming more and more associated with the strategies of the automotive industry and is increasingly dependent on decisions, projects and investments in the automotive industry (Bridge and Faigen 2022).

The impact of electric cars on the economy and the environment is assessed differently (Pirmana et al. 2023). Indonesia is the country with the largest nickel reserves in the world (24%), thanks to the development of electric motorization, it has an excellent opportunity to become one of the main players in the global supply chain for electric vehicles, which will have a positive impact on the country's economy (Pirmana et al. 2023). In the US, the increase in electric-car sales generated economic revenue from USD 23 billion to USD 94 billion and created between 162,000 and 863,000 jobs. The electric-vehicle market in the United States is projected to grow by 18.17% (2023–2028), resulting in a market volume of USD 161.60 billion in 2028 (Alda 2023). An assessment shows that charging electric cars does not necessarily reduce the carbon footprint if the energy does not come from renewable sources. It was also found that every kilometer traveled by an electric vehicle produces 35–50 times more sulfur oxides than a conventional vehicle (Liu et al. 2012).

Europe is currently facing rising product and energy prices. Everything indicates that purchasing power may decrease, which will translate into purchases of new electric cars, the prices of which are rising. The price of an average new car increased by about 27 percent between 2012 and 2021 and this trend is likely to continue as the consumer price index continues to rise (Global Strategy Group 2023). Electric cars are still more expensive than comparable combustion-engine cars. The additional cost (30–50 percent) comes from the cost of the batteries (Analazi 2023). The residual value of electric-car parts is actually EUR 4585 less than in traditional (internal-combustion engine) cars. It can therefore be predicted that the total value of electric cars will fall if the market for original-equipment-manufacturer suppliers expands. The advantage of electric cars also depends on a fall in battery prices. The cost of batteries for electric vehicles should fall, as determined by market analysis. This is mainly due to the increasingly perfect battery technology. On the other hand, the average price of an ICE passenger car is expected to increase over the next decade, driven mainly by price inflation. However, electric cars still have room for maneuver. The cost of batteries for electric cars should fall, as determined

by market analysis. This is mainly due to the increasingly perfect battery technology. On the other hand, the average price of a conventional car powered solely by an internal-combustion-engine (ICE) passenger car is expected to increase over the next decade, mainly by price inflation. In the next few years, the automotive industry is expected to face a significant disruption. Large portions of the supply chain are likely to come under financial stress. Some can be saved—others may not be. Automotive OEMs (Original Equipment Manufacturers) and their suppliers should work as an ecosystem and collaboratively across the industry to ensure the transition is smooth and that key suppliers are not lost.

Regardless of the huge growth of the electric-car market, it is limited to only part of the world. The trend towards full electrification of cars continues in China, Europe and the United States (Winebrake et al. 2017). Around 95% of global sales of electric vehicles are concentrated in these countries. In addition to government subsidies that have just been introduced or still do not exist, the main reasons for the slow progress in other parts of the world are the lack of public charging infrastructure and the high prices of electric vehicles (Alda 2023).

During the first three months of 2023, more than 2.5 million plug-in electric cars were registered around the world, which is about 13 percent of the total volume. Global plug-in-electric-car sales exceeded 1 million in March 2023 (Kane 2023).

One of the biggest disadvantages of electric cars is that charging the car's battery is not convenient if you do not have access to commercial charging stations or at least a charger at home. And even with the faster chargers that you find at commercial stations, it can still take up to 30 min to fully charge your electric car (Winters 2021).

Despite all the problems, sales of electric cars are increasing and demand is expected to increase further (Global EV Outlook 2023). Half of electric-car sales are in China. However, these cars in China are much cheaper than in other countries. For example, in 2022, the weighted average selling price of a small BEV in China was below USD 10,000. In the same year, the price of this car in Europe and the United States exceeded USD 30,000.

6. Discussion

Forecasts predict that the largest growth in the number of electric cars will occur in three countries: China, Europe and the United States. The percentage increase in electric-car sales in these countries will account for 92.45% of the global increase in electric-car sales in 2025 (IEA 2023b; Global EV Outlook 2023). This means that the transformation of the automotive industry is selective and applies mainly to countries with the greatest economic development.

According to a 2023 report (Global EV Outlook by IEA), Norway, Sweden, the Netherlands and Germany remain the largest European markets for electric cars. The net zero emissions (NZE) scenario by 2050 predicts that the number of electric cars will reach 380 million. In turn, electric cars sales will grow to 60% of all vehicle sales in 2030 (2023 Global Electric Vehicle Market Review).

The barriers to promoting the automotive industry are the management of car prices and the lack of sufficient charging infrastructure. In Europe, slow chargers are being replaced by fast and ultra-fast chargers. In 2022, the number of fast chargers increased by over 55% and amounted to almost 70,000 units. Another trend that is constantly growing is the intelligent charging of electric vehicles, i.e., the use of charging devices connected to the cloud (IEA 2023b; Global EV Outlook 2023).

In 2022, electric cars consumed around 110 terawatt hours of electricity, doubling from the previous year. In the future, by 2030, electric cars are expected to consume less than 4% of global electricity consumption. However, with the growing demand for electricity to charge electric cars, there is a growing need to protect and manage the power grid intelligently. Electric cars affect and will significantly affect energy systems.

Lithium-ion batteries based on graphite anodes and layered oxide cathodes (NMC, NCA) dominate in a significant part of electric cars. However, as lithium-ion batteries are beginning to reach their performance limits and their production poses environmental

risks and supply issues, alternatives to lithium-ion batteries are being sought. Advanced battery technologies are emerging, including designs for lithium-ion cells, silicon anodes and solid-state batteries (Gear et al. 2023). The advanced lithium-ion battery contains critical elements and electrolytes with high supply risk. However, lithium-ion batteries are expected to maintain their dominant position. Improving cell design to improve charging speed and energy density will be key.

The limited range of batteries in electric cars is the most severe negative side of electric motoring. The average gasoline car can easily go four- or five-hundred miles on a tank of gasoline. A diesel car can drive about 1120 km. The all-electric Peugeot e-208, on the other hand, needs to be recharged every 350 km (Tallodi 2022). Concerns related to charging infrastructure, namely the location and availability of charging points, is another issue related to electric cars. Long charging times of electric cars are negative in relation to refueling internal-combustion cars. Refueling a petrol or diesel car can take as little as 5 min. Charging an electric vehicle can take anywhere from 30 min to an hour using the latest public fast chargers. Electric cars are fast and have no delays in power delivery. However, if we consider the top segment of the electric-vehicle market, most are limited to relatively low top speeds. Some struggle to reach 144 km/h, while even a basic petrol car reaches 160 km/h. Electric cars usually cost more than their combustion counterparts. An electric car produces zero emissions; however, the method of electricity production has a direct impact on how environmentally friendly it really is. Creating the lithium-ion battery pack is also more environmentally harmful than the manufacturing process for an average petrol-powered car. On the other hand, electric cars can be a great choice. Apart from practical considerations such as low running costs and tax benefits, electric vehicles are smooth and very responsive to drive.

A vehicle is considered clean if it emits a small amount of pollutants. This usually applies to cars running on fuels other than petrol or diesel. The natural-gas vehicle (NGV) thus appears as an ecological alternative to the electric vehicle means of transport (Sneci 2021). As the name suggests, NGVs work on natural gas, which is the same gas that we use every day to heat the house, cook, etc. This primal energy does not require any particular transformation. Biomethane or BioNGV is energy with the same properties as conventional natural gas (Hernández et al. 2023; Amant et al. 2020). However, they are obtained from a renewable source: methanation of organic waste from various industries, such as food processing, gastronomy, agriculture. Biomethane or BioNGV can be used to propel vehicles. The hydrogen vehicle is often compared to the electric vehicle (Kirch 2020). Both types of vehicles do not have an internal-combustion engine and run on electricity. However, their energy source is not the same. Hydrogen-powered vehicles get their energy from a hydrogen-powered fuel cell. The only by-product of the whole process is water and heat, both of which are natural resources.

Forecasts for the car market in Europe suggest that the purchasing power driving this market may decrease due to rising car prices, inflation and declining real consumer incomes (Global Strategy Group 2023). The authors see the risk in this industry both in external circumstances related to threats to the automotive industry and in the need for changes related to the transformation of car drives. A suppression of demand for cars is indicated in the second half of 2023 (Ferraris et al. 2023). A slowdown in consumer demand and higher interest rates will put pressure on prices in 2023.

In Europe, some economic stagnation is expected, but not a recession. As in the USA, car sales cannot be expected to return to pre-pandemic levels. Due to the disruption of supply chains, the global economic downturn and the impact of the pandemic, the automotive industry has weakened. Despite this, it strives for innovation and presents new ideas and solutions that offer consumers more and more technologically advanced cars. Environmental regulations as well as consumer preferences have an impact on the future of the automotive industry. Currently, it seems that electric cars dominate the market in the area of environmentally friendly motoring. However, alternative solutions

such as hydrogen-powered cars and others should be included in the automotive trends of manufacturers.

7. Conclusions

The conducted review of the literature, reports on trends, risks and the future of the automotive industry indicates several main, currently leading issues related to offers for individual consumers.

1. There is an increasing demand for electric cars in several of the world's most economically developed countries such as China, the USA and Europe (as a whole), which is probably related to the price of cars, the number of potential users and environmental awareness.
2. Risks related to electric motoring result primarily from disruptions in supply chains, problems with obtaining rare-earth elements, technological barriers to batteries and insufficient development of charging-station infrastructure.
3. The prices of electric cars are higher than those of combustion cars, which may weaken their demand.
4. It seems that there are few pro-ecological alternatives to electric cars.
5. Protecting the environment by switching to electro-motorization makes sense only when cars will be charged with green energy, and the production of batteries for these cars and other components will have a zero carbon footprint.

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