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Article

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The discordance of governance performance from environmental and social performance on idiosyncratic risk: The effect of board composition

Xin Yang^{1,2}, Ahmad Fahmi Sheikh Hassan^{1*}, Wei Theng Lau¹ and Nazrul Hisyam Ab Razak¹

Abstract: In recent years, the nexus between environmental, social, and governance (ESG) factors and financial performance has been a focal point of academic discourse. While much of the existing literature emphasizes the potential positive correlations between ESG performance and financial gains, ambiguities persist, especially concerning the governance pillar. Against this backdrop, our study delves into the relationship between ESG performance and idiosyncratic volatility, utilizing a comprehensive panel dataset of U.S. listed companies spanning 2005 to 2019. Through analytical methodologies like the two-stage least square method with instrumental variables (2SLS-IV) and the dynamic Generalised Method of Moments (GMM), we unveil an intriguing discovery: governance performance does not significantly correlate with idiosyncratic volatility, whereas environmental and social performance demonstrate a strong negative linkage. This deviation from conventional wisdom underscores our study's unique contributions. We shed light on the governance factor's discordance from its environmental and social counterparts in shaping firm-specific risk, introduce the emerging concept of board composition's moderating effects on the ESG-volatility relationship, and present a holistic perspective by covering an extensive array of U.S. sectors. Our findings carry profound implications for the future trajectory of sustainable investing and corporate governance practices.

Subjects: Investment & Securities; Corporate Governance; Economics

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Keywords: ESG performance; idiosyncratic volatility; discordance; board gender diversity; board size

1. Introduction

Since the 1990s, environmental issues resulting from economic development, coupled with frequent corporate governance scandals such as Enron and Tyco, have heightened investors' concerns. Consequently, environmental, social, and governance (ESG) investments have witnessed exponential growth over the past few decades, capturing the attention of scholars, policymakers, and investors alike. Pástor et al. (2021) suggest that while stocks with high ESG scores might underperform those with low scores, investors are inclined towards them due to their potential as hedges against sustainable risks. Highlighting this shift, the CFA Institute (2023) emphasizes that integrating ESG information into analytical processes aims to mitigate corporate risks by pinpointing and assessing threats that traditional financial metrics might overlook. As a result, corporate ESG practices have progressively influenced stock prices, guiding investment decisions (Chen et al., 2021; Ng & Rezaee, 2020). This investment paradigm, bolstered by the directives and endorsement of the United Nations, has flourished notably over the past decade.

While environmental and social pillars of ESG are often evaluated in the context of environmental risks (e.g., greenhouse gas emissions, waste) and societal consequences (such as community relations and human rights), the governance ("G") pillar frequently goes underexamined (Giese et al., 2021). This oversight may stem from the ongoing debate regarding the efficacy and desirability of ESG-based (stakeholder) governance. For instance, Bridoux and Stoelhorst (2022) draw upon Ostrom's design principles for collective action, suggesting that stakeholder involvement can foster joint value creation. Conversely, Bebchuk and Tallarita (2020) contend that stakeholder governance might not necessarily benefit stakeholders. They argue that it becomes challenging to hold corporate executives accountable, thereby increasing the rift between them and shareholders, which can adversely affect corporate financial performance. This suggests that the practical implementation of ESG-based governance is fraught with complications, with corporate leaders potentially prioritizing operational results that may not optimize shareholder value (Edmans, 2022; Russo, 2008). Consequently, the intricacies surrounding this issue appear to be somewhat sidelined by investors, leaving room for a deeper consideration of how corporate governance policies might need to evolve (Strine et al., 2022).

To unravel the influence of the governance component within ESG on corporate-specific risk, this study probes the relationship between governance performance and idiosyncratic volatility in stock returns. Idiosyncratic volatility, inherently contingent on company-specific characteristics, is influenced by corporate policies. While the environmental and social dimensions under the stakeholder theory haven't faced fervent debates, the governance aspect remains relatively unexplored. This paper, therefore, extends its inquiry to gauge the impacts of environmental and social performance on idiosyncratic volatility. A distinct disparity in the association between governance and idiosyncratic volatility, compared to those of the environmental and social dimensions, would highlight a potential misalignment between the "G" pillar and the "E" and "S" pillars in terms of their effects on firm-specific risk. Further, our exploration of the link between ESG performance and idiosyncratic volatility provides insight into the very fabric of the central debate on Materiality and Stakeholder Engagement (de Villiers et al., 2022). The premise is straightforward yet profound: Does superior ESG performance, as encapsulated by sustainability reporting standards and encouraged by the global reporting initiatives, correlate with a company's stock-specific risk? If so, to what extent, and which ESG pillars have the most pronounced impact?

Moreover, the corporate board serves as a linchpin in internal governance mechanisms, as it charts the strategic direction of a company and engages with the community to benefit all stakeholders, both directly and indirectly (Akisik & Gal, 2017). Consequently, it plays a pivotal role in crafting sustainable strategies and overseeing their execution. Building on the premise that

corporate ESG practices stem from board decisions, recent research has sought to elucidate the interplay between the “G” and “E” and “S” factors. This exploration particularly emphasizes the influence of board composition on these facets (Eliwa et al., 2023; Haque, 2017; Husted & de Sousa-Filho, 2019; Olthuis & van den Oever, 2020; Orazalin & Mahmood, 2021).

Meanwhile, the second objective of this paper is to explore the moderating effects of board gender diversity and board size on the relationships between environmental, social performance, and idiosyncratic volatility. We focus on board gender diversity and board size because they are frequently cited board characteristics in academic literature (Buerthey, 2021; Nguyen & Thanh, 2021). Additionally, there has been mounting pressure on companies from advocacy groups and governmental initiatives to increase the representation of women on their boards of directors (Atena & Tiron-Tudor, 2019; Li et al., 2017). Furthermore, the role of board size, a crucial facet of board structure, has been rigorously debated in terms of its utility as a metric for gauging the effectiveness of boards of directors (Pucheta-Martínez & Gallego-Álvarez, 2020).

This study utilizes a panel dataset from 1,840 U.S. listed companies spanning the years 2005 to 2019. Our findings reveal no significant relationship between governance performance and idiosyncratic volatility. However, both environmental and social performance demonstrate a significant negative correlation with idiosyncratic volatility. Moreover, when analysing the moderating roles of governance mechanisms (specifically board gender diversity and board size) in the relationship between ESG performance and idiosyncratic volatility, we ascertain that the effects of environmental and social performance on idiosyncratic volatility are attenuated by these board characteristics. To ensure the robustness of our results concerning endogeneity and reverse-causality issues, we employ a variety of tests, including alternative models for measuring idiosyncratic volatility, the two-stage least squares method with instrumental variables (2SLS-IV), and the dynamic Generalised Method of Moments (GMM).

As the global discourse shifts and stakeholders increasingly demand transparency and accountability, the pressing need to comprehend these three ESG pillars grows. Set against this vast canvas, our research makes a compelling case. We delve deeply into the individual ESG pillars, unlike many studies which often aggregate the effects. Our empirical analysis delineates a distinctive pattern for the governance pillar (“G”), underscoring its divergence from the environmental (“E”) and social (“S”) components in relation to firm-specific risk. This revelation not only fills a significant gap in our current understanding but also calls for a more nuanced theoretical framework around ESG-based governance and its materiality assessment within the context of sustainability reporting standards and global reporting initiatives.

Furthermore, our exploration into governance mechanisms opens new avenues. We shed light on the intricate dynamics of how board composition, especially factors like board gender diversity and board size, moderates the relationship between ESG performance and idiosyncratic volatility. In an era where there are global appeals for diverse and competent boards, these insights provide a roadmap for corporations to sculpt boards that don’t just comply but actively champion sustainable goals.

Venturing beyond the often-limited geographies or industries of prior research, our study offers a panoramic view by analysing a diverse array of sectors within the U.S. This expansive approach, enriched by our extensive dataset, ensures our conclusions are both holistic and generalizable. The significance of this approach is further magnified when we consider the meteoric rise of sustainable investing in the U.S. In sum, our research does more than just augment the current knowledge pool. It bridges theoretical gaps, answers pressing questions, and charts a course for a more integrative understanding of ESG’s indispensable role in shaping contemporary corporate strategy and risk management.

The remainder of the paper is organized as follows: Section 2 reviews prior research and presents the hypotheses. Section 3 details the data, sample, and research design. Section 4 presents the results, inclusive of various robustness tests. Finally, Section 5 offers the conclusion.

2. Literature review and hypothesis development

2.1. Theoretical framework

Stakeholder theory is fundamental in explaining the rationales behind corporate social and environmental practices. Boards of directors and managers are accountable to stakeholders, and addressing stakeholder concerns can bolster their performance. By enhancing sustainable performance, they not only mitigate risks but also augment the firm's value (Ng & Rezaee, 2015; Rezaee, 2016). Superior ESG performance can bolster a company's public perception, potentially making it an attractive employer, and facilitating the recruitment and retention of top talent (Rezaee, 2019). Godfrey (2005) posits that sustainable practices cultivate moral capital among stakeholders. This "insurance-like" protection manifests when stakeholders maintain a favourable view of a company's ESG initiatives, subsequently fostering loyalty (Luo & Bhattacharya, 2009). In the event of a corporate crisis, this positive perception can temper potential penalties, leading to more stable future cash flows and reduced firm risk (Chang et al., 2014; Qiu et al., 2016)—ultimately translating to diminished idiosyncratic risk. Furthermore, diverse boards, either in terms of size or gender representation, encapsulate varied perspectives, thereby fostering prudent decision-making and robust social capital (Nguyen & Thanh, 2022).

Hussain et al. (2018) argue that both agency and stakeholder theories can elucidate the nexus between boards of directors and sustainability. From the agency theory perspective, the board plays an instrumental role in supervising managerial endeavours and advancing shareholder interests. Nevertheless, the traditional paradigm of shareholder-manager relations is scrutinized by Hart and Zingales (2022), who advocate for the inclusion of other stakeholders in managerial considerations. While management might favour short-term gains, shareholders often seek sustainable performance that promises long-term dividends. This dichotomy can result in potential agency conflicts concerning corporate ESG priorities. Consequently, to enhance management oversight, boards should rigorously evaluate ESG-related managerial decisions to uphold sustainable corporate performance. Given that the incentives presented to board members can differ, larger boards are better equipped to fulfil this oversight role (Kyereboah-Coleman & Biekpe, 2006).

On the other hand, stewardship theory underscores potential negative associations between board dimensions, gender diversity, and corporate ESG performance. Within a stewardship framework, an optimally-sized board facilitates more intensive advisory roles for its directors (Gubitta & Gianecchini, 2002). These directors, dedicated to the company's objectives, would prioritize its welfare over personal interests (Chindasombatcharoen et al., 2022). Meanwhile, gender biases or entrenched male stereotypes might inhibit the contributions of female directors to decision-making and, by extension, ESG outcomes (Galbreath, 2011; Wang et al., 2021). Under such circumstances, there's less imperative to expand the board or increase female representation. Stewards, after all, emphasize business continuity and nurture stronger affiliations with pertinent stakeholders—factors that invariably enhance corporate ESG performance (Cuadrado-Ballesteros et al., 2017; Miller et al., 2008).

In this study, the confluence of stakeholder, agency, and stewardship theories provides a comprehensive lens to decipher the multifaceted relationships under exploration. Stakeholder theory acts as a foundational scaffold, asserting that companies thrive when they consider and address the interests of all stakeholders, not just shareholders. This theory adeptly elucidates the relationship between environmental and social performance with idiosyncratic risk, suggesting that firms addressing broader stakeholder concerns are better positioned to manage unforeseen risks, aligning with their broader commitment to environmental and social tenets. While agency theory postulates potential conflicts between managers and shareholders, it suggests that diverse or larger boards might bolster a firm's risk management through ESG practices by enhancing monitoring and aligning interests. In contrast, stewardship theory presents a more collaborative perspective. Stewards, often embodied by dedicated managers or board members, prioritize company welfare over personal interests. This implies that a diverse or larger board isn't essential

to enhance a firm's risk management via ESG practices, and may produce counterproductive effects. The tension and complementarity between these theories form the bedrock of our investigation, helping decipher the intricate dynamics of corporate governance, ESG practices, and risk management.

2.2. Governance performance and idiosyncratic volatility

There exists considerable debate within many studies regarding the definition of governance within the ESG framework (Auer & Schuhmacher, 2016; Eccles et al., 2014; Khalid et al., 2022; Khan, 2019). Traditionally, governance has been evaluated based on how responsive the management of publicly listed companies is to their shareholders. This traditional viewpoint maintains that shareholders' primary goal is value maximization, leaving little room for other objectives, including social ones (Benson & Davidson, 2010; O'Connell & Ward, 2020; Tirole, 2001). Conversely, ESG-centric governance asserts that managers should prioritize the interests of various stakeholder groups—such as employees, consumers, and the community—potentially over those of the company's shareholders. This approach posits that corporations should exhibit environmental responsiveness and social awareness, even as they pursue profit (Hart & Zingales, 2022). This governance perspective embedded in the ESG framework (termed stakeholder governance) deviates from the traditional governance metrics (shareholder governance). As such, the merits traditionally associated with excellent corporate governance shouldn't be conflated with ESG attributes, given the stark difference in underlying principles between the two (Cornell, 2020; Edmans, 2022; Servaes & Tamayo, 2013).

Khan (2019) notes that shareholder governance presents quantifiable and objective costs and benefits, making the capital allocation process more structured and clear-cut. In contrast, stakeholder governance introduces multifaceted objectives, necessitating a delicate balance of interests across varying stakeholders. This increases the challenge of precisely quantifying and reconciling costs and benefits in capital allocation decisions and executing a sustainable long-term business strategy. Further, Bebchuk and Tallarita (2020) contend that companies with a stakeholder governance approach might sometimes prioritize particular stakeholders, even if it comes at the expense of shareholders, to enforce policies that are more stakeholder-friendly. In juxtaposing the goal of profit maximization for shareholders, Becchetti et al. (2015) argue that placating a diverse group of stakeholders is a nuanced strategy. Such firms may face constraints in their ability to adjust stakeholders' well-being to meet earnings objectives, especially during periods of adverse productivity shocks. Consequently, these companies may grapple with unpredictable earnings and might not align with typical stock market trends, rendering their stocks more susceptible to misvaluation compared to less stakeholder-oriented entities.

Nevertheless, a myriad of studies advocate for a more comprehensive corporate governance perspective that extends beyond mere economic considerations (Carney et al., 2020; McGahan, 2020). Firstly, corporate legislation and case law don't mandate shareholder value maximisation (Stout, 2012). This challenges the long-held belief that prioritizing shareholder interests is the inherent purpose of corporations (Gill, 2008). Secondly, the rising incidence of corporate scandals has gradually expanded the scope of corporate governance. The focus has shifted from solely addressing agency conflicts to encompassing ethical and socially responsible objectives (Buttner & Lowe, 2017; Elkington, 2006; Morris et al., 2017). Thirdly, the pursuit of shareholder value maximisation often overlooks the legitimate economic interests of other stakeholders, which can sometimes lead to suboptimal value creation for the firm (Barney, 2018; Klein et al., 2012; Rajan & Zingales, 2000). Concurrently, several studies indicate that companies with sound governance structures exhibit superior environmental stewardship and heightened social responsibility. Harjoto and Jo (2011) observed a correlation between exceptional corporate governance and enhanced corporate social responsibility. Ferrell et al. (2016) posited that companies which shield minority shareholders from potential excesses of controlling shareholders and insiders are more inclined towards social responsibility initiatives. They deduce that optimal corporate governance can be a precursor to elevated social responsibility performance.

This intricate relationship introduces ambiguity for investors when deciphering the governance component of ESG investments. To mitigate this confounding influence, Chen et al. (2021) excluded the corporate governance dimension in their ESG information flow analysis. Similarly, Ng and Rezaee (2020) examined if individual ESG sustainability components impacted stock price informativeness. Their findings revealed that the influences of environmental and social sustainability overshadowed that of governance sustainability. Given these interpretations and the absence of a definitive trajectory, we propose our hypothesis in its null form:

H1: The performance of the governance pillar of ESG is not significantly correlated with idiosyncratic volatility.

2.3. Environmental, social performance and idiosyncratic volatility

It is generally established that ESG performance is pivotal in enhancing a company's reputation (Reber et al., 2022). Within this connotation there is an inference on a negative correlation between ESG and idiosyncratic volatility. Horn (2023), for example, discovered that even companies with lower ESG ratings exhibit significantly lower idiosyncratic risk compared to stocks without any ESG rating. This is attributed to the benefits of ESG ratings in reducing information asymmetries and enhancing transparency concerning ESG issues. While this correlation on idiosyncratic risk is expressed in relation to ESG, examining the connections between the environmental and social pillars and a company's risk offer another insight. Relationships cultivated through environmental and social responsibility can reduce a company's risk. Such relationships often ensure stakeholders' support and provision of resources, especially when they believe their interests are considered (Attig & Cleary, 2015; Deng et al., 2013). For instance, fostering positive ties with primary stakeholders enhances a company's capacity to secure capital, especially from socially responsible investors. Consequently, firms with robust stakeholder connections are less exposed to financial risk. Notably, superior social performance contributes to the accumulation of invaluable intangible resources, like top-tier staff and customer loyalty (Malik, 2015). These resources are pivotal for a firm's strategic profitability and competitive edge. Likewise, a commendable environmental performance indicates a firm's genuine commitment to societal welfare and reduces associated environmental risks. Hoepner et al. (2016) postulate that effectively addressing environmental issues predominantly curtails downside risk. Given the positive association between environmental risk and idiosyncratic risk (Metcalf et al., 2016), there should be a negative correlation between environmental performance and idiosyncratic volatility.

Furthermore, environmental and social engagement are antecedents of corporate reputation, and firms with better reputations among industry professionals own more transparent information environments (Borzino et al., 2023; Duff, 2016; Iglesias et al., 2020). This aligns with the reputation-building perspective rooted in stakeholder theory. It perceives corporate environmental and social responsibilities as tactical endeavours to nurture and sustain a positive business reputation, subsequently refining the informational environment. If external parties deem environmental and social responsibilities as credible indicators, then leveraging these responsibilities as signalling tools could diminish information asymmetry. It can provide a more effective communication channel for managers to engage stakeholders. For example, Wang et al. (2019) indicated a positive market reaction towards firms acknowledging their environmental responsibility. This positive reception is attributed to the firms' transparency in their environmental activities and their consistent record of environmental improvements. In the same vein, Bilal et al. (2022) concluded that there is a tangible enhancement in financial reporting quality when environmental information disclosures are made. Their findings highlighted a negative relationship between such disclosures and discretionary accruals. Expanding on this, Cheng and Feng (2023) identified that a firm's operating cash inflow is significantly influenced by stakeholder behaviour. As environmental information reshapes stakeholder attitudes, it can consequently help mitigate cash flow risk. Companies, especially those grappling with heightened monitoring costs, risks, and adverse selection, might find it beneficial to disclose more refined non-financial data to earn consumer

trust. Therefore, excellence in environmental and social responsibility should correlate negatively with reputational risks, thereby diminishing the asymmetry risk that exists between managers and stakeholders (Cai et al., 2016).

However, divergent perspectives exist concerning the relationship between corporate sustainable information and firm risk. Kulkarni (2000) contends that the disclosure of a corporation's environmental information, including details about its products, operations, and waste, might be asymmetric between the firm and stakeholders. This asymmetry could result from instances where corporations engage in environmental practices primarily as a smokescreen to conceal misconduct through "greenwashing." Such masking might generate noise, albeit investors might perceive it as valuable information, thus potentially overlooking other fundamental aspects of the firm and misvaluing stock prices (Hemingway & MacLagan, 2004). Unscrupulously, involvement in sustainability initiatives has been suggested to be driven by the necessity to conceal managerial wrongdoing, potentially elevating the likelihood of risks arising from corporate misconduct. Companies build up reputational capital by embracing social responsibilities to alleviate adverse investor judgments and acquire reputation insurance to counteract unfavorable incidents (Zhang et al., 2022). Additionally, there is a proclivity for executives to allocate excessive resources to corporate social responsibility to achieve their own remuneration, professional advancement, organizational expansion, and political progression, which further amplifies the concealing impact (Chintrakarn et al., 2020). Zhang et al. (2021) ascertain that the disclosure of corporate social responsibility information can mitigate the erosion of corporate value resulting from financial restatements.

Empirically, the relationship between social responsibility and idiosyncratic volatility has also produced mixed results in the literature. Becchetti et al. (2015), for instance, found a positive correlation between social responsibility and idiosyncratic volatility. Conversely, He et al. (2022) demonstrated an inverse relationship between the two. This inconsistency can be attributed to the emergence of two distinct types of idiosyncratic volatility in financial literature: absolute and relative idiosyncratic volatility. Prior studies have established that these two measures are not interchangeable and frequently yield divergent findings (Aabo et al., 2017; Bartram et al., 2012; Li et al., 2014; Zhang et al., 2016). Relative idiosyncratic volatility is commonly employed as an indicator of stock price informativeness. Nevertheless, some research has inappropriately utilized relative idiosyncratic volatility as a gauge of firm-specific risk (e.g. Ayton et al., 2022; Becchetti et al., 2015; Izcan & Bektas, 2022). Recognizing this oversight, our study exclusively adopts absolute idiosyncratic volatility as its measure.

Consequently, our hypothesis posits:

H2: Environmental and social performance are negatively correlated with idiosyncratic volatility.

2.4. The moderating effects of board gender diversity on the relationships between environmental and social performance and idiosyncratic volatility

Numerous studies have posited that boards tend to be more attuned to sustainability issues when they have a higher proportion of female directors (Amorelli & García-Sánchez, 2021; Ferrero-Ferrero et al., 2015; Kassinis et al., ; Orazalin & Baydauletov, 2020; Post et al., 2011). A potential reason is the increasing education and training of women in the humanities, which fosters sustainable engagement (García Martín & Herrero, 2020). Additionally, gender disparities have led more women to work in companies emphasizing sustainability than their male counterparts (Galbreath, 2011). Liao et al. (2015) further argue that introducing diverse perspectives, communication styles, and experiences by increasing gender diversity enriches decision-making in sustainability practices.

Empirical findings indicate that companies with more female directors are more likely to undertake corporate social responsibility initiatives (Fernandez-Feijoo et al., 2014; Nadeem et al., 2017; Valls Martinez et al., 2019) and are less likely to lay off employees (Matsa & Miller, 2013).

Arayakarnkul et al. (2022) delve into board gender diversity's connection to corporate social commitment and sustainability, emphasizing the critical role boards play in establishing value-creating stakeholder relationships. Likewise, Li et al. (2017) examine the interplay between gender diversity on boards and firms' environmental policies, highlighting its importance for sustainable development and corporate governance. Liu (2018) observes that boards with a higher proportion of women face fewer environmental lawsuits, although the cost of improving environmental performance might outweigh the savings from avoiding these lawsuits. Kreuzer and Priberny (2022) analyse how board characteristics, including gender diversity, influence carbon emissions, offering insights into the complex dynamics between corporate boards and environmental performance. From the perspective of the stakeholder theory, an increased number of women on boards enhances stakeholder engagement and heightens the emphasis on sustainable goals (Hussain et al., 2018). Yet, some studies, aligned with the stewardship theory, have either found a negative association or no significant correlation at all (Khan et al., 2021; Rao & Tilt, 2016; Rodriguez-Dominguez et al., 2009). For instance, Zaid et al. (2020) noted that while a higher proportion of female directors positively influences sustainable performance, the effect is statistically insignificant. Interestingly, in a cross-country study spanning Asia and Europe, Almaqtari et al. (2023) found that board diversity correlates positively with environmentally friendly production in European corporations. In contrast, there is a negative correlation in Asian corporations. Such variations arise from differences in the governance practices of these companies. Given this context of varied findings, our hypothesis is framed as follows:

H3: Board gender diversity moderates the associations between environmental and social performance and idiosyncratic volatility.

2.5. The moderating effects of board size on the relationships between environmental and social performance and idiosyncratic volatility

The size of a corporate board can influence its ability to function effectively. Hussain et al. (2018) argued that a larger board size can diminish governance efficiency. Echoing stewardship theory, Chindasombatcharoen et al. (2022) observed a negative correlation between board size and corporate innovation, suggesting smaller boards might be more committed to their objectives and the company's success. Similarly, Ongsakul et al. (2021) posited that a reduced board size bolsters corporate governance. Larger boards can face challenges with cohesion, increased communication costs, and a higher likelihood of forming factions, which might lead to an inadequate focus on the executive role in business sustainability (Nguyen & Thanh, 2021). In contrast, Khan et al. (2021) claimed that larger boards are more effective in their monitoring roles, advocating for sustainability initiatives that enhance shareholder value.

Research has indicated that board size positively impacts environmental performance, evidenced by reduced greenhouse gas emissions (Haque & Ntim, 2018) and more transparent greenhouse gas emission disclosures (Mahmood & Orazalin, 2017). In line with stakeholder theory, Zubeltzu-Jaka et al. (2020) suggested that larger boards tend to prioritize stakeholder interests, guiding firms towards sustainable objectives. However, some studies have found no link between board size and ESG initiatives (Amran et al., 2014). García Martín and Herrero (2020) explored board characteristics associated with enhanced corporate sustainability but did not find a significant link between board size and environmental sustainability. The influence of board size on corporate risk is also debated. For instance, Su et al. (2019) found that a larger board correlates with reduced corporate risk in China, while Akbar et al. (2017) found no such connection in the U.K. financial sector between 2002 and 2012.

Given these varied findings, this study will not make direct assumptions about the relationship between board size, sustainable corporate performance, and idiosyncratic volatility. Instead, it seeks to illuminate the interplay between board size, environmental, and social performance on idiosyncratic stock volatility. Therefore, our hypothesis is:

H4: Board size moderates the associations between environmental and social performance and idiosyncratic volatility.

3. Methodology

3.1. Data and sample

This study extracts the data available from DataStream for Refinitiv ESG performance score, board gender diversity and board size of U.S. listed companies. Other data were collected from the centre for Research in Security Price (CRSP). The sample excluded financial firms, such as banks, investment companies, insurance companies, etc., because they have unique characteristics and regulatory environments. Financial firms are highly leveraged, which has a different meaning for nonfinancial firms (Aabo et al., 2017; Fama & French, 1993; Ferreira & Laux, 2007). This study also excludes the technology sector because tech firms have the characteristics of information asymmetry (Liao & Lin, 2017), which also causes high idiosyncratic volatility. This is because to innovate, the tech sector needs massive ongoing investments in research and development, yet they cannot disclose their thoughts and strategies with fund sources owing to the risk of copying. As corporate ESG practice is an extra expenditure and against the background of the perception of risk in the technology industry, more disclosure of non-financial information about ESG performance may exacerbate information asymmetry in the tech sector (Nazir et al., 2022). Furthermore, all continuous variables were winsorised at 1% or 99% level to prevent the results from the affection of outliers. The final sample netted 8150 firm-year observations for 1840 listed companies from 2005 to 2019. Table 1 reports the sample distribution by year and sector.

3.2. Variables in the study

3.2.1. Idiosyncratic volatility

Following Ang et al. (2006), we measure the idiosyncratic volatility as the standard deviation of residual stock returns from Fama and French's (1993) three-factor model:

$$r_{i,d} = \alpha_i + \beta_1 r_{m,d} + h_i HML + s_i SMB + \varepsilon_i \quad (1)$$

Where $r_{i,d}$ is the excess stock return on day d for firm i ; $r_{m,d}$ is the daily excess return of the value-weighted market index; HML and SMB are the value-based risk premium factor and size-based risk premium factor. The regression is repeated yearly to obtain the standard deviation of each company's residual. The square root of the number of trading days per year for the corresponding stock is multiplied to annualize the standard deviation.

3.2.2. ESG performance

This study used the Refinitiv ESG score as an ESG performance measure, which can be collected from the DataStream database. Refinitiv (formerly Thomson Reuters financial and risk business department) is one of the world's largest financial market data and infrastructure providers. It provides services to more than 40 000 institutions in about 190 countries, including providing world-leading ESG data, insights, and trading platforms, connecting important global financial markets. Based on published data that is available to the public, the Refinitiv ESG score is regarded as a thorough assessment of the company's sustainability effect and conduct.

3.2.3. Control variables

This study controls for variables previously found to be related to idiosyncratic stock volatility, including return on asset (ROA), firm size (SIZE), leverage (LEV), firm age (AGE), market-to-book ratio (M.B.) and capital expenditure (CAPEX). ROA measures firms' profitability, which is the ratio of earnings to total assets (Shan et al., 2014). We also control firm size, measured as the natural logarithm of total assets at the end of each fiscal year (Wang & Sarkis, 2017). LEV is defined as the ratio of long-term debt to book value of total assets (Shan et al., 2014). Firm age is measured by the natural logarithm of one plus the number of years since the firm was first covered by the

Table 1. The number of companies per year and sector

Panel A: number of companies per year			Panel B: number of companies per sector		
Year	N	%	Sector	N	%
2005	231	2.27	Academic& Educational Services	80	0.79
2006	260	2.56	Basic Materials	826	8.12
2007	271	2.66	Consumer Cyclical	2,246	22.08
2008	298	2.93	Consumer Non-Cyclical	833	8.19
2009	388	3.82	Energy	751	7.38
2010	447	4.4	Healthcare	1,789	17.59
2011	475	4.67	Industrials	2,006	19.72
2012	489	4.81	Real Estate	1,063	10.45
2013	497	4.89	Utilities	576	5.66
2014	506	4.98			
2015	542	5.33			
2016	932	9.16			
2017	1,305	12.83			
2018	1,689	16.61			
2019	1,840	18.09			

Notes: this table presents the distribution of the number of firms across year and sector. TRBC Economic Sector Classifications are used to categorise sectors.

Centre for Research in Securities Prices (CRSP) (Aabo et al., 2017). Market-to-Book is measured as the market value of equity divided by the book value of equity (Doukas & Kim, 2010). The CAPEX is measured as capital expenditure divided by the total asset (Titman et al., 2004).

3.2.4. Moderating variables

This study uses the proportion of women on the board as a proxy for board gender diversity (GEND). The percentage of female on the board of directors is between 0% and 100%. The board size (BSIZE) is the total number of board members at the end of the fiscal year (Huang & Wang, 2015). The Refinitiv database is used to extract information on the gender composition and size of each company's board of directors. Table 2 provides definitions of all variables used in this study.

3.3. Descriptive statistics and correlations

3.3.1. Descriptive statistics

Table 3 reports the descriptive statistics regarding all variables for the sample. ESG_{t-1} , ENV_{t-1} , SOC_{t-1} , and GOV_{t-1} , are the primary variables of ESG and its' pillars' performance measure at time $t-1$. The mean governance performance score (GOV_{t-1}) is 50.979, with a standard deviation of 21.579. The mean environmental performance score (ENV_{t-1}) is 28.435, with a standard deviation of 27.866. The mean social responsibility performance score (SOC_{t-1}) is 43.394, with a standard deviation of 20.563. The mean ESG performance score (ESG_{t-1}) is 41.557, with a standard deviation of 19.084. The dependent variable, idiosyncratic volatility (IV), has a mean of 31.064% with a standard deviation (S.D.) of 19.788%.

Regarding the control variables, companies have an average ROA_{t-1} of 0.039. The mean of company size ($SIZE_{t-1}$) is 8.461. The leverage (LEV_{t-1}) ratio shows a mean value of 0.261. The mean AGE_{t-1} of the companies is 3.025. The book-to-market (M.B. $t-1$) ratio indicates that the

Table 2. Definitions of variables used

Variable	Description
Dependent	
IV	Idiosyncratic Volatility
Independent	
ESG performance variables	
GOV	Governance dimension of ESG performance
ENV	Environmental dimension of ESG performance
SOC	Social dimension of ESG performance
ESG-perform	Overall ESG performance based on Refinitiv ESG score
Control	
ROA	Return on assets. The ratio of net income to total assets.
SIZE	Firm size. Natural log of total asset.
LEV	Firm leverage. The ratio of long-term debt to total assets.
AGE	Natural log of one plus firm age, where the firm age equals the number of years since the stock inclusion in the CRSP database.
MB	Market-to-book equity ratio. The ratio of market value of equity divided by the book value of equity.
CAPEX	Capital expenditure. The ratio of capital expenditure to total asset.
Moderators	
GEND	Gender diversity. The percentage of female director on board.
BSIZE	Board size. The number of members on board.

market value is 3.542 times the book value of equity on average. $CAPEX_{t-1}$ shows that 4.2% of total assets are invested in capital expenditure. The moderator variable, board gender diversity ($GEND_{t-1}$), shows an average 15.7% of females on the board, with a standard deviation of 9.999. Board size ($BSIZE_{t-1}$) shows a mean value of 9.791 with a standard deviation of 2.211.

Table 4 reports the correlation between the idiosyncratic volatility and the overall ESG performance, environmental, social, governance pillars' performance and control variables. Univariate analysis suggests a negative relationship exists between idiosyncratic volatility and ESG and its pillars' performance. Correlation coefficients suggest that companies with strong ESG performances have lower idiosyncratic volatility if the other effects are not controlled. For example, the correlation between company size ($Size_{t-1}$) and ESG and its pillars are relatively high and significant, which may influence univariate results and necessitates controlling for these variables in multivariate analysis. The correlations between ESG performance and other variables are relatively low in light of the multicollinearity issue. In addition, this study calculated the variance inflation factor (VIF), which indicates severe multicollinearity problem exists if it exceeds 10. As shown in Table 5, no VIF is higher than 1.64. Therefore, the multicollinearity issue should not be a concern of this study.

3.4. Empirical models

3.4.1. ESG and its pillars' performance and idiosyncratic volatility

Toward investigating how ESG and its pillars' performance are correlated with stock-specific volatility, the following panel data regression model in Equation (2) is examined.

Table 3. Descriptive statistics for the variables

Variable	Mean	SD	Median	Min	Max	N
IV _t	31.064	19.788	25.011	10.495	188.591	9966
GOV _{t-1}	50.979	21.579	52.014	5.026	92.681	8159
ENV _{t-1}	28.435	27.866	20.99	0	89.705	8242
SOC _{t-1}	43.394	20.563	39.997	6.925	92.013	8159
ESG _{t-1}	41.557	19.084	38.14	7.866	86.352	8158
ROA _{t-1}	0.039	0.109	0.049	-0.74	0.286	8159
SIZE _{t-1}	8.461	1.485	8.508	4.143	12.012	8158
LEV _{t-1}	0.261	0.177	0.252	0	0.849	8242
AGE _{t-1}	3.025	0.821	3.135	0.693	4.043	8273
MB _{t-1}	3.542	4.661	2.588	-26.071	42.734	8150
CAPEX _{t-1}	-0.042	0.040	-0.032	-0.239	0.000	8241
GEND _{t-1}	15.704	9.999	15.385	0	44.444	8044
BSIZE _{t-1}	9.791	2.211	10	5	16	8153

Notes: this table presents descriptive statistics for the sample firms of the study. The table provides the mean, standard deviation, median, minimum, maximum, and the number of observations for the panel data set from year 2005 to 2019.

$$IV_{i,t} = \delta_0 + \delta_1 ESGP_{i,t-1}^k + \delta_2 ROA_{i,t-1} + \delta_3 SIZE_{i,t-1} + \delta_4 LEV_{i,t-1} + \delta_5 AGE_{i,t-1} + \delta_6 MB_{i,t-1} + \delta_7 CAPEX_{i,t-1} + YearFE + FirmFE + \varepsilon_{i,t} \quad (2)$$

Where, subscripts *i* and *t* stand for company and year. *IV_{i,t}* denotes the dependent variable representing the idiosyncratic volatility measure of firm *i* at year *t*. Similarly, ESGP is the ESG and its pillars' performance scores at year *t-1*, *k* represents either environmental, social, governance or ESG. $\varepsilon_{i,t}$ is the error term. To estimate the equations, we employed the linear least squares approach using fixed-effects panel regressions, controlling for both firm and year specific effects. All equations are estimated using robust standard errors.

3.4.2. The moderating effects of board gender diversity and board size

In order to investigate the moderating effects of board gender diversity and board size in the ESG performance-idiosyncratic risk relationships, this study includes the interaction terms between the board gender diversity, board size measures and ESG and individual environmental and social performance scores, as shown in Equation (3).

$$IV_{i,t} = \delta_0 + \delta_1 ESGP_{i,t-1}^c + \delta_2 BOARD_{i,t-1}^m + \delta_3 ESGP_{i,t-1}^c * BOARD_{i,t-1}^m + \delta_4 ROA_{i,t-1} + \delta_5 SIZE_{i,t-1} + \delta_6 LEV_{i,t-1} + \delta_7 AGE_{i,t-1} + \delta_8 MB_{i,t-1} + \delta_9 CAPEX_{i,t-1} + YearFE + FirmFE + \varepsilon_{i,t} \quad (3)$$

Where BOARD is the board composition, *m* represents either board gender diversity or board size. ESGP is the ESG and social and environmental performance scores at year *t-1*, *c* represents either environmental, social or ESG. We similarly employed the linear least squares method to estimate equations (3), using the same methodology as for equation (2), leveraging fixed-effects panel regressions and controlling for both firm and year-specific effects. Each equation is assessed with robust standard errors.

4. Empirical findings

4.1. ESG performance and idiosyncratic volatility

This study set out to analyse the relationships between the individual pillars of ESG performance and idiosyncratic volatility. The data in columns (1) to (3) of Table 6 validate the claims made in

Table 4. Pearson correlation coefficients													
	IV _t	ESG _{t-1}	ENV _{t-1}	SOC _{t-1}	GOV _{t-1}	ROA _{t-1}	SIZE _{t-1}	LEV _{t-1}	AGE _{t-1}	M.B. _{t-1}	CAPEX _{t-1}	GEND _{t-1}	BSIZE _{t-1}
IV _t	1												
ESG _{t-1}	-0.255***	1											
ENV _{t-1}	-0.255***	0.873***	1										
SOC _{t-1}	-0.179***	0.866***	0.705***	1									
GOV _{t-1}	-0.231***	0.658***	0.413***	0.360***	1								
ROA _{t-1}	-0.402***	0.146***	0.161***	0.072***	0.141***	1							
SIZE _{t-1}	-0.359***	0.532***	0.566***	0.441***	0.312***	0.242***	1						
LEV _{t-1}	-0.091***	0.069***	0.085***	0.068***	0.068***	-0.060***	0.236***	1					
AGE _{t-1}	-0.273***	0.362***	0.354***	0.252***	0.302***	0.250***	0.355***	-0.036***	1				
MB _{t-1}	-0.01	0.023**	0.01	0.041***	-0.036***	0.037***	-0.061***	-0.041***	-0.029***	1			
CAPEX _{t-1}	-0.030***	-0.053***	-0.090***	0.005	-0.058***	-0.120***	-0.076***	0.079***	-0.088***	-0.004	1		
GEND _{t-1}	-0.125***	0.373***	0.293***	0.301***	0.297***	0.094***	0.176***	0.029***	0.218***	0.051***	-0.009	1	
BSIZE _{t-1}	-0.222***	0.448***	0.473***	0.371***	0.223***	0.173***	0.538***	0.059***	0.383***	-0.002	-0.095***	0.222***	1

Notes: This table reports the correlation coefficients between the idiosyncratic volatility, ESG, ESG pillars, gender diversity, board size and control variables for the overall sample. * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

hypotheses 1 and 2. Specifically, column (1) reveals an insignificant relationship between governance performance and idiosyncratic volatility. However, columns (2) and (3) distinctly indicate that environmental and social performances are inversely related to idiosyncratic volatility. The environmental pillar stands out as the most influential on idiosyncratic volatility, evidenced by a coefficient of -0.046 at a 1% significance level (t -statistics = -3.19), followed by the social pillar at a coefficient of -0.034 at a 5% significance level (t -statistics = -2.13). This divergence between the “G” factor and the “E” and “S” factors suggests that investors perceive the “G” pillar differently when evaluating the implications of ESG practices on a corporation’s risk profile.

In our exploration of governance performance’s impact on idiosyncratic volatility, we found no significant correlation. This observation echoes the findings of Eliwa et al. (2021), who investigated the influence of corporate governance on the cost of debt, revealing an insignificant relationship. While one might anticipate strong governance to manifest in reduced firm-specific risks like idiosyncratic volatility, or even lower borrowing costs due to decreased perceived risks, both our study and that of Eliwa et al. (2021) challenge these presumptions. It prompts a reconsideration of established views, such as those presented by Chen et al. (2009) and Cheng et al. (2006), which associate robust governance with diminished firm risk and decreased information asymmetry. The inverse associations we discovered between both environmental and social performance and idiosyncratic volatility harmonize with prior findings underpinned by the stakeholder theory. Echoing this, Dobler et al. (2014) previously identified a negative correlation between environmental performance and environmental risk. This is further bolstered by the findings of Metcalf et al. (2016), who reported a direct relationship between environmental risk and idiosyncratic risk. The observed negative linkage between social performance and idiosyncratic volatility underscores the importance of valuing stakeholder advantages in risk analyses. This mirrors the findings of El Ghoul et al. (2011), who emphasized that corporations with a strong emphasis on social responsibility benefit from reduced equity capital costs. Importantly, this resonates with the assertions of Dumitrescu & Zakriya (2021) that firms excelling in social responsibility can mitigate business risks by curbing the likelihood of management withholding detrimental information, which, if disclosed, could precipitate stock price downturns.

As presented in Column 4 of Table 6, the coefficient for overall ESG performance stands at -0.055 , which is statistically significant at the 1% level (t -statistics = -2.65). This suggests that companies exhibiting superior ESG performance tend to experience reduced idiosyncratic volatility. Intriguingly, even though the governance pillar alone did not show a significant relationship with idiosyncratic volatility, the cumulative influence of the ESG components is noticeably inverse with this volatility. Consequently, the apparent lack of impact from the “G” factor does not deter firms from mitigating risks through comprehensive ESG practices. This observed inverse relationship between consolidated ESG performance and idiosyncratic volatility resonates with findings from earlier research. For instance, both Hong and Liskovich (2015) and Jagannathan et al. (2018) identified similar trends in their studies. Thus, the results in Table 6 lend robust empirical support to hypotheses 1 and 2.

Rooted in the stakeholder theory, these findings suggest firms emphasizing environmental and social tenets are better poised to navigate firm specific risks. Moreover, the collective influence of ESG components, despite the muted impact of governance alone, significantly mitigates idiosyncratic risk. These findings offer pragmatic insights for investors and policymakers. The effects of different ESG pillars on idiosyncratic volatility necessitate a more granular approach in ESG investment, rather than a one-size-fits-all method. Stakeholders, including institutional investors, can harness this knowledge to tailor their investment and engagement strategies, thereby realizing the dual benefits of sustainable practices and reduced investment risks. In this light, policy-makers should play their part to consider refining stakeholder-based governance guidelines that enhance firm risk management.

4.2. The moderating effects of gender diversity and board size

The results from Column 1 of Table 7 reveal an interesting dynamic between board gender diversity and environmental performance. Although Orazalin and Baydauletov (2020) postulated that board gender diversity could potentially weaken the relationship between social responsibility strategy and environmental performance, our findings suggest a non-significant impact on idiosyncratic risk. Specifically, the coefficient of $ENV_{t-1} * GEND_{t-1}$ is positive but statistically insignificant. This suggests that the merits of strong environmental performance in mitigating idiosyncratic risk aren't considerably influenced by the gender composition of the board. In contrast, Column 2 unveils a discernible impact of gender diversity on the relationship between social performance and idiosyncratic risk, with the coefficient of $SOC_{t-1} * GEND_{t-1}$ being significant at the 10% level (t -statistic = 1.67). This indicates that a higher proportion of female directors can indeed attenuate the correlation between social performance and idiosyncratic volatility. Drawing from Post et al. (2011), this could be attributed to gender-based variations in ethical judgement. The diversity in ideologies, which Olthuis and van den Oever (2020) noted to have an inverse relationship with social performance, could be a contributing factor.

Column 3 further underscores the role of gender diversity, indicating its significant moderating influence on the association between overall ESG performance and idiosyncratic volatility. The coefficient of $GEND_{t-1} * ESG_{t-1}$ is significant at the 10% level (t -statistic = 1.68). This finding, aligned with Dong et al. (2023), suggests that a greater number of female board directors might somewhat dampen the benefits of ESG performance in terms of reducing idiosyncratic risk. Thus, while championing board gender diversity is crucial for various reasons, in the context of leveraging ESG activities to minimize idiosyncratic risk, it may not always yield the expected benefits.

Column (1) of Table 8 reveals a noteworthy interaction between board size and environmental performance when considering idiosyncratic volatility. With an interaction coefficient of 0.008 at the 10% significance level (t -statistic = 1.81), the findings suggest that the beneficial influence of environmental performance on idiosyncratic volatility wanes in companies with larger boards. Drawing from past literature, this observation aligns with the idea that larger boards are often more susceptible to contraventions of environmental regulations (Kassinis & Vafeas, 2002; Taurangana et al., 2017). Such transgressions, once made public, can beget both direct consequences like penalties and indirect ramifications, such as reputational setbacks. This can, in turn, ratchet up the idiosyncratic risk associated with these firms. On the other hand, the moderating effect of board size on the relationship both social and the aggregate ESG performance with idiosyncratic volatility appears negligible as evidenced by Columns 2 and 3. This resonates with past studies which have highlighted a non-significant association between board size and the fervor for sustainability initiatives (Amran et al., 2014; Oware et al., 2022).

In summary, drawing on the stewardship theory, which suggests that managers and board members prioritize the company's long-term welfare, the dynamic between board characteristics and ESG performance becomes intriguing. Our results highlight a non-significant relationship between board gender diversity and environmental performance. The lack of a pronounced effect of board size in these domains is congruent with the stewardship theory (Cuadrado-Ballesteros et al., 2017). In a related vein, Zhou (2022) posited that overzealous CSR activities in firms with larger boards might inadvertently undermine shareholder interests. Yet, when considering firms with a higher proportion of female directors, the benefits of social performance in risk mitigation appear to lessen. This outcome may be rooted in diverse ethical judgments and decision-making processes inherent to gender-diverse boards. Furthermore, the reduced impact of environmental performance on risk in firms with larger boards can be attributed to potential coordination challenges or the broader scope of oversight, despite inherent intentions for the company's well-being (Nguyen & Thanh, 2022). In the pursuit of maximizing ESG benefits, cultivating a stewardship-driven culture that aligns with these objectives is essential, transcending the monitoring implications proposed by agency theory.

Table 5. Multicollinearity checks

Variable	VIF	1/VIF
ESG _{t-1}	1.46	0.686967
ENV _{t-1}	1.51	0.661717
SOC _{t-1}	1.28	0.780300
GOV _{t-1}	1.14	0.874822
SIZE _{t-1}	1.64	0.608386
AGE _{t-1}	1.23	0.811276
ROA _{t-1}	1.12	0.890787
LEV _{t-1}	1.13	0.887776
CapEx _{t-1}	1.03	0.971438
MB _{t-1}	1.02	0.983618

4.3. Robustness checks

This section provides the conclusions of sensitivity analyses that were done to test the viability of the primary findings on the relationship between each individual pillars, overall ESG performance and idiosyncratic volatility under various model specifications and underlying assumptions. The results of robust tests do not vary significantly from the conclusions of our baseline analysis.

4.3.1. Alternative models for measuring the idiosyncratic volatility

This study starts the robustness checks by using two different models to measure idiosyncratic volatility. First, this study estimates idiosyncratic volatility by using the market model to regress stock returns on the market index returns, as suggested by Aabo et al. (2017). The regression model is estimated as follows:

$$r_{i,d} = \alpha_i + \beta_i r_{m,d} + \varepsilon_i \quad (4)$$

Second, this study uses the Carhart (1997) four-factor model that includes a momentum factor in addition to the Fama and French (1993) three factors to measure the idiosyncratic volatility. The following equation characterises the regression equation:

$$r_{i,d} = \alpha_i + \beta_i r_{m,d} + h_i HML + s_i SMB + c_i UMD + u_i \quad (5)$$

Table 9 reports the results, columns (1) to (4) show the estimated coefficients with idiosyncratic volatility calculated from the market model as the dependent variables, and columns (5) to (8) present the results by using the Carhart (1997) four-factor model. These results show that the environmental and social pillars' performance and overall ESG performance significantly and negatively correlated with idiosyncratic volatility, and governance performance is not significantly correlated with the idiosyncratic volatility. The results confirm our earlier conclusions.

4.3.2. Endogeneity

One of the potential concerns that might lead the ESG-idiosyncratic volatility relationship to inaccurate inference is the reverse causality issue. For instance, a company's decision to participate in ESG activities may not be independent of the companies' risk. Nevertheless, in the baseline regressions, this study has already attempted to solve these concerns by using the lagged ESG and its pillars' performance scores to guarantee a temporal lag between the ESG performance scores and the following impacts in idiosyncratic volatility. In addition, although the previous analysis of this study controlled for essential variables that may impact the idiosyncratic volatility identified in the literature, it is possible that the nexus of ESG performance factors and idiosyncratic volatility is being influenced by missing variables that are associated with both the explanatory and the dependent variables. Therefore, if any independent variables

Table 6. Effects of ESG and its pillars' performance on idiosyncratic volatility (Fama-French three-factor model)

	(1)	(2)	(3)	(4)
GOV _{t-1}	-0.004 (-0.38)			
ENV _{t-1}		-0.046*** (-3.19)		
SOC _{t-1}			-0.034** (-2.13)	
ESG _{t-1}				-0.055*** (-2.65)
ROA _{t-1}	-25.523*** (-5.59)	-27.947*** (-6.11)	-26.600*** (-5.83)	-26.777*** (-5.96)
SIZE _{t-1}	-0.187 (-0.21)	0.092 (0.10)	0.127 (0.14)	0.076 (0.09)
LEV _{t-1}	8.848*** -3.79	8.491*** -3.34	9.747*** -4.06	9.300*** -3.95
AGE _{t-1}	-4.697*** (-2.92)	-4.628*** (-2.75)	-4.926*** (-2.95)	-4.427*** (-2.64)
M.B. _{t-1}	-0.078* (-1.91)	-0.080* (-1.91)	-0.076* (-1.81)	-0.073* (-1.74)
CAPEX _{t-1}	-17.320* (-1.78)	-21.755** (-2.16)	-21.677** (-2.12)	-22.930** (-2.25)
_cons	42.175*** (5.06)	39.603*** (4.60)	40.509*** (4.71)	40.129*** (4.72)
Year F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
N	7408	7476	7423	7419
r ²	0.182	0.188	0.19	0.187
r ² _a	0.18	0.186	0.188	0.184
F	28.052	28.559	28.481	28.897

Notes: t-statistics in parentheses, * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

are endogenous, the OLS may provide inconsistent parameter estimates and biased results (Larcker & Rusticus, 2010; Nikolaev & Van Lent, 2005).

In particular, two distinct and well-established econometric techniques are employed to enhance the robustness of the results to address endogeneity and reverse causality concerns. First, we utilize two-stage least squares (2SLS) with instrumental variables (IV) methods, which are commonly used in applied econometrics for identification, estimation, and inference in models with endogenous explanatory variables (Horowitz, 2011). The author utilises the average industry scores of each ESG pillar and overall ESG performance serving as one of the instruments for the corresponding ESG pillars and overall ESG performance to the main models following Eliwa et al. (2021) and Kim et al. (2014). The average industry score is not expected to be correlated with idiosyncratic volatility but linked with a company's ESG performance scores. In addition, this study uses a dummy variable as an additional instrument covering the political affiliation of residents in the U.S. federal state where the company's headquarters is located (Deng et al., 2013). This "blue state"¹ dummy is assigned the value 1 if a state votes for the democratic presidential candidate in

both the most recent and subsequent presidential elections in a given year, and it is assigned the value 0 otherwise. Previous research has shown that democratic voters seem to have a greater interest in social responsibility initiatives, which suggests a higher level of pressure on the relevant corporations to participate more extensively to environmental and social activities (Albuquerque et al., 2019; DiGiuli & Kostovetsky, 2014; Kim et al., 2020). Therefore, the “blue state” dummy should correlate with the companies’ environmental and social performance, while the political orientation of the states should not directly impact their stocks’ idiosyncratic volatility. Consequently, it explicitly considers political allegiance functions as an exogenous and valid instrumental variable. However, this blue state dummy may not be associated with corporate governance performance. Thus, besides the industry average governance scores, this study also

Table 7. The moderating roles of board gender diversity

	(1)	(2)	(3)
ENV _{t-1}	-0.059** (-2.49)		
SOC _{t-1}		-0.065** (-2.46)	
ESG _{t-1}			-0.087*** (-2.72)
GEND _{t-1}	-0.024 (-0.60)	-0.091 (-1.53)	-0.087 (-1.41)
ENV _{t-1} *GEND _{t-1}	0.001 (1.01)		
SOC _{t-1} *GEND _{t-1}		0.002* (1.67)	
ESG _{t-1} *GEND _{t-1}			0.002* (1.68)
ROA _{t-1}	-26.796*** (-5.83)	-26.783*** (-5.64)	-25.799*** (-5.70)
SIZE _{t-1}	0.217 (0.25)	0.334 (0.38)	0.161 (0.19)
LEV _{t-1}	7.773*** (3.03)	7.606*** (2.74)	8.504*** (3.62)
AGE _{t-1}	-4.566*** (-2.67)	-4.823*** (-2.82)	-3.975** (-2.41)
MB _{t-1}	-0.068 (-1.65)	-0.064 (-1.54)	-0.062 (-1.50)
CAPEX _{t-1}	-19.819** (-2.04)	-20.041** (-2.03)	-20.701** (-2.10)
_cons	38.772*** (4.64)	40.241*** (4.84)	39.482*** (4.85)
Year F.E.	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes
N	7231	7179	7176
r ²	0.196	0.195	0.196
r ² _a	0.194	0.193	0.193
F	26.323	26.753	26.902

Notes: t-statistics in parentheses, * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

Table 8. The moderating roles of board size

	(1)	(2)	(3)
ENV _{t-1}	-0.118*** (-2.59)		
SOC _{t-1}		-0.013 (-0.23)	
ESG _{t-1}			-0.132* (-1.93)
BSIZE _{t-1}	-0.207 (-0.79)	0.109 (0.32)	-0.307 (-0.79)
ENV _{t-1} *BSIZE _{t-1}	0.008* (1.81)		
SOC _{t-1} *BSIZE _{t-1}		-0.002 (-0.30)	
ESG _{t-1} *BSIZE _{t-1}			0.008 (1.24)
ROA _{t-1}	-27.400*** (-5.95)	-27.327*** (-5.76)	-26.355*** (-5.81)
SIZE _{t-1}	-0.114 (-0.13)	-0.043 (-0.05)	-0.154 (-0.18)
LEV _{t-1}	8.069*** (3.14)	8.039*** (2.89)	8.777*** (3.71)
AGE _{t-1}	-4.285** (-2.56)	-4.981*** (-3.00)	-4.003** (-2.49)
M.B. _{t-1}	-0.080* (-1.91)	-0.073* (-1.73)	-0.071* (-1.69)
CAPEX _{t-1}	-16.968* (-1.78)	-17.161* (-1.77)	-17.706* (-1.83)
_cons	42.641*** (5.09)	41.361*** (4.71)	44.134*** (5.04)
Year F.E.	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes
N	7349	7296	7291
r ²	0.197	0.195	0.195
r ² _a	0.194	0.192	0.193
F	28.307	28.491	28.523

Notes: t-statistics in parentheses, * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

employs the average governance scores in each state where the company's headquarters is located as the second instrumental variable for the governance pillar performance.

Second, this study considers applying the System Generalised Method of Moments (SYS-GMM) technique developed by Arellano and Bover (1995), which has been used in the fields of ESG and finance to address the issue of reverse causality (Eliwa et al., 2021; Kim et al., 2014). Since the cause-and-effect relationship between factors changes with time, the SYS-GMM method is the most effective way to address these challenges and is well-suited for achieving reliable equation evaluations. Thus, this study employs the dynamic models, which equip lags of dependent

Table 9. Effects of ESG and its pillars' performance on idiosyncratic volatility (the market model and Fama-French four-factor model)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ENV _{t-1}	-0.049*** (-3.32)				-0.045*** (-3.21)			
SOC _{t-1}		-0.034** (-2.08)				-0.033** (-2.14)		
GOV _{t-1}			-0.004 (-0.32)				-0.005 (-0.42)	
ESG _{t-1}				-0.057*** (-2.70)				-0.055*** (-2.70)
ROA _{t-1}	-29.751*** (-6.26)	-28.407*** (-5.98)	-27.274*** (-5.73)	-28.568*** (-6.10)	-27.354*** (-6.05)	-25.978*** (-5.77)	-24.984*** (-5.55)	-26.149*** (-5.88)
SIZE _{t-1}	0.033 (0.04)	0.071 (0.08)	-0.258 (-0.28)	0.022 (0.02)	-0.031 (-0.04)	-0.01 (-0.01)	-0.301 (-0.35)	-0.054 (-0.06)
LEV _{t-1}	9.419*** (3.60)	10.671*** (4.30)	9.799*** (4.05)	10.211*** (4.21)	8.352*** (3.32)	9.640*** (4.07)	8.721*** (3.78)	9.172*** (3.95)
AGE _{t-1}	-4.825*** (-2.80)	-5.173*** (-3.02)	-4.958*** (-3.01)	-4.660*** (-2.73)	-4.333*** (-2.59)	-4.641*** (-2.80)	-4.396*** (-2.76)	-4.135*** (-2.49)
M.B. _{t-1}	-0.093** (-2.17)	-0.089** (-2.06)	-0.091** (-2.15)	-0.085** (-1.98)	-0.075* (-1.84)	-0.071* (-1.75)	-0.075* (-1.86)	-0.069* (-1.68)
CAPEX _{t-1}	-22.564*** (-2.19)	-22.433** (-2.15)	-17.922* (-1.79)	-23.820** (-2.28)	-18.289* (-1.85)	-18.127* (-1.81)	-14.144 (-1.48)	-19.293* (-1.93)

(Continued)

Table 9. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
_cons	40.991*** (4.63)	42.004*** (4.73)	43.792*** (5.09)	41.615*** (4.75)	39.660*** (4.66)	40.692*** (4.78)	42.155*** (5.11)	40.248*** (4.78)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	7474	7421	7406	7417	7477	7423	7409	7420
r ²	0.204	0.206	0.199	0.203	0.185	0.187	0.18	0.184
r ² _a	0.202	0.204	0.196	0.201	0.183	0.185	0.177	0.182
F	28.895	29.066	28.65	29.356	28.37	28.179	27.751	28.623

Notes: t-statistics in parentheses, * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

variables to re-estimate the baseline models by using SYS-GMM to assess the robustness of our earlier findings.

Columns (1) to (4) of Table 10 report the results of IV-2SLS regressions. Both of the environmental performance and social performance are significantly and negatively correlated with idiosyncratic volatility; governance performance has no significant effect on idiosyncratic volatility. The Kleibergen-Paap tests demonstrate that this study does not under identify the instrumental variables. The Wald F statistics prove that they are not weak instrumental variables. Meanwhile, Hansen J statistics indicate that the models are not overidentified. Columns (5) to (8) report the dynamic models' results using the SYS-GMM. Again, the results show that reversal-causality is unlikely to be driving our previous findings. The AR(1) test indicates it is first-order correlated, and AR(2) test shows that second-order serial correlation is not significant. Furthermore, there is no overidentification issue, as shown by Hansen J statistics.

4.3.3. *Inclusion of companies in the technology sector*

To assess whether the technology sector demonstrates unique associations between ESG (and its pillars) performance and idiosyncratic volatility, we conducted a new analysis using equation (2), incorporating data from the technology sector. The outcomes are outlined in Table 11. Columns (1), (3), and (4) reveal that the coefficients for governance, social, and overall ESG performance are not significant. As depicted in column (2), there's a notable negative correlation between environmental performance and idiosyncratic volatility. However, both the coefficient and the level of significance for environmental performance are lesser than the results in Table 6. Such findings imply that robust environmental and social performance in tech firms might increase their firm-specific risk, a conclusion that contrasts with our observations from other sectors. This observation resonates with Nazir et al. (2022) who posited that the distinct attributes of the technology sector mean that ESG performance has a positive correlation with the cost of capital. Factors intrinsic to the tech sector, such as its high R&D intensity and growth (Nunes et al., 2012) and heightened information asymmetry (Liao & Lin, 2017), might shape the ESG strategies of tech firms and influence their idiosyncratic volatility.

5. Conclusion

This study was embarked upon with the aim of exploring the intricate relationship between ESG performance and its pillars with idiosyncratic volatility. Our goal was to unravel the potential risk implications associated with sustainable and responsible business practices. Utilizing panel data regression models, we delved deeply into the dynamics between ESG performance, its individual pillars, and idiosyncratic volatility. Our methodology was reinforced by the inclusion of robustness checks employing alternative models and an attentive addressal of potential endogeneity concerns through the application of two-stage least squares with instrumental variables (2SLS-IV) and the System Generalised Method of Moments (SYS-GMM).

One of our major findings highlighted the significant and negative correlation between the environmental and social pillars of ESG performance with idiosyncratic volatility. This underscores their potential role in mitigating firm-specific risks. In contrast, the governance pillar did not exhibit a substantial correlation. Moreover, our study introduced the novel angle of evaluating the interactions between board gender diversity, board size, and ESG performance, adding layers of complexity to the discourse.

Our research contributes a fresh perspective to the literature, providing an exhaustive exploration of the dynamics between ESG performance and its individual pillars with firm-specific risk. This unique angle of probing into the moderating effects of board characteristics sets our study apart. From an implication standpoint, our findings bear importance for both academicians, practitioners and policy makers. Academics are offered a new lens, emphasizing the dissection of ESG performance into individual pillars when analysing financial outcomes. For practitioners, especially investors, our insights could prove invaluable in strategizing investment portfolios, hinting at

Table 10. Endogeneity test: 2SLS-IV and dynamic GMM regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IV _{t-1}					0.213*** (5.24)	0.211*** (4.92)	0.174*** (3.95)	0.197*** (4.73)
ENV _{t-1}	-0.385*** (-4.79)				-0.177** (-2.53)			
SOC _{t-1}		-0.310** (-2.52)				-0.364** (-2.51)		
GOV _{t-1}			-0.042 (-0.99)				-0.191 (-1.37)	
ESG _{t-1}				-0.609*** (-3.49)				-0.277*** (-2.58)
ROA _{t-1}	-28.192*** (-6.78)	-24.946*** (-6.14)	-24.808*** (-6.23)	-26.668*** (-6.47)	-21.016 (-1.46)	-22.626 (-1.33)	-45.207** (-1.98)	-25.612* (-1.72)
SIZE _{t-1}	1.797** (2.13)	1.495 (1.60)	0.096 (0.15)	2.260** (2.31)	-0.665 (-0.60)	0.086 (-0.06)	-1.575 (-1.59)	-0.482 (-0.41)
LEV _{t-1}	5.052** (2.04)	9.943*** (4.53)	8.880*** (4.33)	7.646*** (3.22)	20.737** (2.51)	20.843** (2.46)	31.698** (1.97)	21.882*** (2.67)
AGE _{t-1}	-0.954 (-0.64)	-3.169** (-2.31)	-3.534*** (-2.64)	0.919 (-0.46)	0.13 (0.15)	0.467 (0.48)	-0.049 (-0.03)	0.351 (0.38)
M.B. _{t-1}	-0.082* (-1.80)	-0.062 (-1.38)	-0.086** (-2.05)	-0.064 (-1.32)	-0.289 (-1.50)	-0.167 (-0.82)	-0.475 (-0.93)	-0.194 (-1.06)

(Continued)

Table 10. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAPEX $t-1$	-28.625*** (-3.10)	-28.077*** (-2.85)	-18.806** (-2.11)	-29.307*** (-3.01)	23.421 (0.80)	15.321 (0.49)	4,791 (0.09)	19,364 (0.66)
_cons					27.510*** (2.64)	0 (0)	0 (0)	31.524*** (3.34)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6952	6916	6890	6905	7387	7335	7321	7334
r ²	0.073	0.143	0.183	0.048				
Kleibergen-Paap Under.(p)	0.000	0.000	0.000	0.000				
Cragg-Donald Wald F statistic	96.696	54.821	248.954	41.134				
Hansen J Statistic Overid (p)	0.5102	0.1107	0.3375	0.4510	0.182	0.154	0.109	0.138
AR(1)					0.000	0.000	0.000	0.000
AR(2)					0.226	0.152	0.115	0.178

Notes: t-statistics in parentheses, * indicate significance at 10%, ** indicate significance at 5%, *** indicate significance at 1%.

Table 11. Effects of ESG and its pillars' performance on idiosyncratic volatility (inclusion of companies in the technology sector)

	(1)	(2)	(3)	(4)
GOV _{t-1}	0.000			
	(-0.05)			
ENV _{t-1}		-0.027*		
		(-1.86)		
SOC _{t-1}			-0.012	
			(-0.74)	
ESG _{t-1}				-0.028
				(-1.40)
ROA _{t-1}	-20.611***	-22.606***	-22.413***	-21.578***
	(-5.59)	(-6.07)	(-5.92)	(-5.90)
SIZE _{t-1}	-0.615	-0.432	-0.364	-0.483
	(-0.77)	(-0.55)	(-0.45)	(-0.61)
LEV _{t-1}	7.693***	7.513***	7.425***	8.318***
	(3.94)	(3.50)	(3.27)	(4.23)
AGE _{t-1}	-4.082***	-4.131***	-4.338***	-4.043***
	(-4.14)	(-4.04)	(-4.17)	(-3.97)
M.B. _{t-1}	-0.058	-0.056	-0.051	-0.049
	(-1.64)	(-1.57)	(-1.41)	(-1.37)
CAPEX _{t-1}	-6.841	-11.176	-11.176	-12.03
	(-0.80)	(-1.23)	(-1.21)	(-1.31)
_cons	45.104***	43.732***	43.996***	44.331***
	(6.61)	(6.37)	(6.33)	(6.51)
Year F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
N	8855	8932	8867	8866
r ²	0.186	0.188	0.189	0.188
r ² _a	0.184	0.186	0.187	0.187
F	35.367	35.34	36.079	36.229

a potential risk reduction mechanism via robust ESG practices. For policy makers, popularizing the concept of ESG materiality could pinpoint the investment value of “G” at the convergence of shareholders’ and stakeholders’ interests.

Despite our rigorous approach, we acknowledge certain limitations. Notably, this study investigated only board gender diversity and board size as board characteristics. Other board attributes, such as board background and skills, board cultural diversity, CEO-chairman duality, and the number of independent members, might directly or indirectly influence ESG performance and idiosyncratic volatility. On one hand, given its non-significant correlation in our analysis, the governance pillar offers a promising avenue for deeper exploration. Future studies could aim to enhance the stakeholder governance theory, potentially breaking the deadlock of pluralistic stakeholderism in practice. On the other hand, it would be beneficial for future research to examine whether these attributes or other governance mechanisms have a moderating effect on idiosyncratic volatility. This could facilitate better alignment of the “G” factor with the “E” and “S” factors. In summation, our research offers pivotal insights into the nexus between ESG performance and idiosyncratic volatility. With the global emphasis on sustainable business growing, deepening our grasp of these dynamics becomes ever more essential.

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Data availability statement

Raw data were generated at Refinitiv and the Center of Research in Security Prices (CRSP). Derived data supporting the findings of this study are available from the corresponding author on request.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Correction

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Note

1. The “blue state” refers to U.S. states whose voters vote for democratic party.

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