Journal of East European Management Studies

J. East Eur. Manag. Stud. **2026**; 31(5): 47183
https://doi.org/10.31083/JEEMS47183

Article

Does Ownership Structure Influence the Nexus Between ESG Performance and Firm Risk-Taking? Evidence From Chinese Firms

Zarafsha Luqman[1], Kaodui Li[1,*], Abdullah[2]

[1]School of Finance and Economics, Jiangsu University, 212013 Zhenjiang, Jiangsu, China
[2]School of Economics, Finance and Banking, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia
*Correspondence: d@ujs.edu.cn (Kaodui Li)

Academic Editors: Thomas Steger and Sui Sui
Submitted: 9 October 2025 Revised: 10 April 2026 Accepted: 13 May 2026 Published: 23 October 2026

Abstract

The Environmental, Social, and Governance (ESG) paradigm has gained increasing attention as firms face pressure to adopt socially and environmentally responsible policies. Given its importance, this study addresses knowledge gaps by investigating whether ESG performance affects firm risk-taking. Further, it examines how ownership structure influences the relationship between ESG performance and firm risk-taking. A rigorous methodology comprising four statistical techniques and several measures of the variables was employed to ensure the robustness of the results. The findings suggest that ESG performance positively and significantly influences firm risk-taking. Moreover, we report novel findings that institutional, state, and foreign ownership significantly moderate the relationship between ESG performance and firm risk-taking. Further heterogeneity analyses revealed that ESG performance positively and significantly influences firm risk-taking in both environmentally sensitive and non-sensitive industries.

Keywords: ESG; risk-taking; institutional ownership; state ownership; foreign ownership; moderation analysis
JEL: G32, G34, M14, Q56, G38

1. Introduction

Environmental, Social, and Governance (ESG) performance has gained significant global attention in recent years, as it addresses critical issues beyond profitability, such as environmental protection, social equity, and ethical governance, while reinforcing shareholder's rights and overall well-being (Chen et al., 2026; de Souza Barbosa et al., 2023). Stakeholders now expect firms to pursue financial success while aligning sustainability goals and disclosing information about their environmental and social impacts. This shift has highlighted the importance of sustainable strategic decision-making, prompting firms to allocate resources to enhance their ESG performance (Khamisu et al., 2024). Consequently, many firms have transitioned from purely profit-driven models to sustainability-driven models. As part of this transformation, ESG reporting has become a crucial tool for communicating corporate sustainability efforts (Sharma et al., 2025). Therefore, ESG practices are now routinely reported, and several agencies assign ESG scores based on a firm's disclosure. A high ESG score indicates a company's strong commitment to responsible practices, enhancing its credibility and stakeholder trust (Aziz and Alshdaifat, 2024).

Globally, ESG practices have gradually developed through changing corporate norms, beginning in the 1980s with Environmental, Health, and Safety (EHS) practices, followed by corporate sustainability in the 1990s, and then corporate social responsibility in the 2000s. This global momentum represents a significant shift in business practices and has impacted major economies, including China. However, regulatory and market forces have been advancing ESG engagement in China. The China Securities Regulatory Commission (CSRC), Shenzhen Stock Exchange, and Shanghai Stock Exchange issued a notice in December 2008 requiring listed companies to disclose Corporate Social Responsibility (CSR) reports. Later, the importance of social responsibility was further emphasized during the Third Plenary Session of the 18th Central Committee of the Communist Party of China (CPC). In response, the China Enterprise Evaluation Association, in collaboration with the School of Social Sciences at Tsinghua University, drafted and issued the "Evaluation Criteria for Corporate Social Responsibility of Chinese Enterprises" in 2014, while the 19th CPC National Congress reiterated the need for companies to take responsibility for societal well-being. Despite these efforts, by December 2019, only 1006 of the 3939 listed firms on the Shenzhen and Shanghai Exchanges had fully disclosed CSR reports, representing just 26% of the total (Wu et al., 2021). Furthermore, China's corporate responsibility has evolved significantly over the past two decades, from mandatory CSR disclosure in 2008 to a fully integrated ESG framework. For instance, the New Environmental Protection Law of 2015 strengthened pollution control and enforcement measures, while air, water, and soil regulations enacted between 2013 and 2017 reinforced ecological governance (Harper Ho, 2018). Additionally, the Green Credit Guidelines in 2012, the Green Bond Framework in 2016, and China's evolving ESG disclosure re-

Copyright: © 2026 The Author(s). Published by IMR Press.
This is an open access article under the CC BY 4.0 license.

Publisher's Note: IMR Press stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

quirements in 2021, including certain environmental information for key polluting enterprises, have encouraged companies to adopt sustainable business practices. These combined efforts have strengthened ESG integration in China and shaped the firm's behavior (Zhou and Nian, 2024).

Numerous researchers have attempted to evaluate ESG performance considering the growing importance of ESG practices. For instance, previous studies have analyzed the effect of ESG performance on firm performance, firm value, cost of debt, and financial performance (Bissoondoyal-Bheenick et al., 2023; Cheng et al., 2025; Fuadah et al., 2022; Halid et al., 2023; Maji and Lohia, 2023; Rahman et al., 2025; Wu et al., 2022; Yavuz et al., 2025). However, after reviewing the literature, we found that the link between ESG performance and firm risk-taking has received considerable attention. Yet the findings are inconsistent, providing mixed evidence on ESG performance and firm risk-taking. For example, Landi et al. (2022) and Saidane and Abdallah (2021) found that ESG positively affects firm risk-taking. Similarly, Sun et al. (2024) examined Chinese A-share-listed companies on the Shanghai and Shenzhen Stock Exchanges and found that ESG performance facilitates firm risk-taking. Evidence from other regions also supports this view and identifies a significant positive relationship between ESG performance and systematic risk among non-Shariah-compliant sample firms in Malaysia (Abdullah and Haron, 2023). In Association of Southeast Asian Nations (ASEAN) countries, ESG practices are associated with greater strategic risk-taking among innovative firms (Setiarini et al., 2023). From a conceptual perspective, examining the relationship between ESG performance and firm risk-taking is critical because firm risk-taking is a core strategic mechanism through which firms pursue long-term value creation. ESG engagement does not merely reflect ethical or compliance-oriented behavior; rather, it reshapes a firm's governance structures, information environments, and stakeholders' relationships, all of which directly influence managerial risk preferences and strategic discretion. On one hand, ESG practices can mitigate downside risk by reducing regulatory exposure, reputational damage, and stakeholder conflicts (Bouslah et al., 2018; Eccles et al., 2014). On the other hand, strong ESG performance may enhance a firm's access to resources, innovation capacity, and stakeholder's support, thereby increasing its ability and willingness to undertake strategic risk-taking aimed at sustainable growth (Landi et al., 2022; Sun et al., 2024). This dual role of ESG suggests that its impact on firm risk-taking is theoretically ambiguous and context-dependent, making risk-taking a particularly meaningful outcome variable for understanding the strategic consequences of sustainability engagement.

In contrast, some studies have reported a negative relationship, indicating that ESG performance can reduce a firm's propensity to take excessive risks. For instance, Handajani et al. (2022) and Liu and Song (2025) provide evidence from Chinese firms that ESG performance lowers firm risk-taking. Similarly, Adardour et al. (2025) examined French firms, while Lee and Koh (2024) examined U.S. financial firms and found that higher ESG performance is associated with lower firm risk. The coexistence of these contrasting findings suggests that the relationship between ESG performance and firm risk-taking is inherently complex. ESG engagement may simultaneously discipline excessive risk by improving governance quality and stakeholder's monitoring, while also enabling firms to undertake higher strategic risk by enhancing legitimacy, access to resources, and long-term growth opportunities. This dual nature of ESG performance implies that its impact on firm risk-taking is unlikely to be uniform across firms and may depend critically on firm-specific governance structures. Taken together, these arguments suggest that ESG performance is not merely an ethical signal but a strategic factor that may fundamentally reshape a firm risk-taking behavior. Therefore, the first objective of the study is to investigate whether ESG performance affects a firm risk-taking.

Furthermore, the literature review revealed that ownership structure influences firm risk-taking behavior and promotes ESG performance (Rieg and Ulrich, 2024; Sallemi and Zouari, 2024; Vuong et al., 2024). Also, ownership structure is crucial in shaping firm decision-making, governance effectiveness, and firms responsiveness to ESG-related risks (Bilyay-Erdogan and Öztürkkal, 2023; Khaliq, 2024). Accordingly, ownership structure may influence how ESG performance affects firm risk-taking decisions. Despite its theoretical relevance, empirical research on how ownership structure moderates the relationship between ESG performance and firm risk-taking remains scarce. In this context, the ownership structure serves as a central governance mechanism through which strategic decisions, including ESG engagement and risk-taking behavior, are shaped and constrained. Different types of owners vary in their monitoring capacity, investment horizons, and risk tolerance, thereby influencing how ESG initiatives are implemented and translated into a firm's outcome. Institutional, state, and foreign owners can strengthen oversight, reduce managerial opportunism, and promote long-term strategic alignment, potentially amplifying the behavioral effects of ESG performance. As a result, ownership structure is likely to influence whether ESG engagement leads to conservative risk management or encourages value-enhancing strategic risk-taking. Despite its theoretical importance, empirical evidence on the moderating role of ownership structure in the ESG-risk-taking relationship remains limited, especially in emerging markets such as China. Therefore, our second objective is to investigate whether the ownership structure moderates the relationship between ESG performance and firm risk-taking, using a two-way interaction approach.

To achieve these objectives, we used a sample of Chinese non-financial firms, comprising 25,686 firm-year observations from 2015 to 2024. The study has focused on the Chinese listed non-financial firms for several reasons. To begin with, China is one of the world's fastest-growing economies, and it has taken significant steps towards environmental protection. Additionally, China has set a goal of achieving peak carbon emissions by 2030 and carbon neutrality before 2060, underscoring its commitment to sustainable development. In this context, we believe that evaluating the ESG performance of Chinese non-financial firm's offers timely and relevant insights. The study uses fixed effects (FE) and feasible generalized least squares (FGLS) for empirical estimation, ensuring robust results across different statistical techniques. Moreover, we employed two-stage least squares (2SLS) and two-step generalized method of moments (GMM) to address potential endogeneity. In addition, for further analysis, we examine ESG performance in environmentally sensitive and environmentally non-sensitive industries using FE. Understanding how ESG performance shapes a firm risk-taking and how this relationship is influenced by ownership structure carries important theoretical, policy, and managerial implications for policymakers, regulators, and managers. As ESG disclosure requirements become increasingly mandatory, regulators must assess whether ESG initiatives constrain excessive risk or facilitate strategic risk-taking necessary for innovation and sustainable growth. Likewise, ESG is an important indicator for managers to support strategic decisions, risk management, and long-term investment; however, their interpretation may vary depending on ownership structure. Clarifying these mechanisms is therefore essential for designing effective ESG policies and for evaluating the risk implications of sustainability-oriented firm strategies.

This study contributes to the growing literature in several important ways. First, it contributes conceptually and empirically to the understanding of the relationship between ESG performance and firm risk-taking by providing a clear economic interpretation of why and how ESG performance influences a firm risk-taking.

While prior studies have predominantly focused on the effects of ESG performance on financial performance, firm value, or cost of capital (Bissoondoyal-Bheenick et al., 2023; Landi et al., 2022; Liu and Song, 2025). Research examining ESG performance and firm risk-taking remains limited and conceptually fragmented. Existing evidence remains mixed; some studies suggest that ESG practices reduce risk-taking by enhancing transparency and stakeholder trust (Handajani et al., 2022; Wu et al., 2022), whereas others argue that ESG engagement may increase risk-taking due to long-term strategic investments and innovation-oriented activities (Saidane and Abdallah, 2021; Yavuz et al., 2025).

However, this literature lacks a clear economic interpretation of ESG-induced risk-taking. It offers limited insight into how ESG engagement shapes a firm risk-taking, particularly in emerging markets. In this context, our study goes beyond mixed evidence and demonstrates that ESG performance positively and significantly influences firm risk-taking. Further, this study extends the ESG literature by providing additional empirical insights into the association between ESG performance and a firm risk-taking. Second, this study investigated the moderating role of ownership structure across three dimensions, i.e., institutional, state, and foreign ownership. Previous research highlights the role of ownership structure in shaping corporate governance, firm value, and sustainability outcomes (Sallemi and Zouari, 2024; Vuong et al., 2024). There is a limited understanding of how ownership structure moderates ESG performance and firm risk-taking. Our findings reveal that institutional, state, and foreign ownership positively and significantly moderate the effect of ESG performance on firm risk-taking. This evidence suggests that diverse ownership structures not only enhance monitoring and discipline but also provide firms with strategic guidance, legitimacy, and long-term orientation, thereby encouraging firm risk-taking. By evaluating this moderating role, the study bridges the ESG and corporate governance literatures. It offers new insights into how ownership heterogeneity shapes ESG-driven risk behavior in China's unique institutional environment.

Third, the study contributes by examining industry heterogeneity in the relationship between ESG performance and the firm risk-taking. Previous studies have highlighted the importance of industry-specific environmental pressures and stakeholder expectations in shaping firm's ESG-related outcomes (Garcia et al., 2017; Matakanye et al., 2021). By differentiating between environmentally sensitive and non-sensitive industries, our analysis shows that ESG performance significantly affects firm risk-taking in both categories. This finding underscores the robustness and generalizability of the relationship between ESG performance and firm risk-taking, suggesting that sustainability engagement consistently shapes a firm's strategic risk behavior, regardless of environmental intensity. Consequently, this study broadens the scope of ESG research and provides more nuanced evidence to guide policymakers and managers across various industrial contexts.

The remaining paper is structured as follows: Section 2 presents the literature review, theoretical background, and hypotheses development, followed by Section 3, which discusses methodology. Section 4 presents empirical results and their discussion, followed by Section 5, which provides further analysis. Lastly, Section 6 presents the conclusions, implications, and limitations.

2. Literature Review and Hypotheses Development

2.1 Theoretical Background

The relationship between ESG performance and firm risk-taking can be explained using stakeholder theory and risk management theory. The Stakeholder theory posits that a firm's long-term success depends on its ability to balance and satisfy the interests of multiple stakeholders, including investors, employees, regulators, customers, and society at large (Freeman, 2010; Pong and Fong, 2024). Firms that actively invest in ESG practices signal ethical conduct, transparency, and social responsibility, which enhances stakeholder trust and legitimacy. This trust reduces uncertainty, lowers conflict-related costs, and improves access to critical resources such as capital and market opportunities (Grant, 1991). As a result, improved ESG performance may enable firms to undertake more strategic and productive firm risk-taking, particularly in innovation-oriented and long-term projects. While stakeholder theory explains why ESG engagement encourages firm risk-taking, risk management theory explains how ESG practices shape the efficiency and discipline of firm risk-taking.

From the perspective of risk management theory, firms adopt structured approaches to identify, assess, and mitigate risk to ensure stability and sustainable performance (Kaplan and Mikes, 2020). Effective ESG-driven risk management helps firms distinguish between value-enhancing risks and excessive speculative risks. However, the extent to which ESG-driven risk management influences firm risk-taking outcomes also depends on internal governance mechanisms, particularly ownership structure. Hence, the relationship between ESG performance, firm risk-taking and ownership structure, can be explained by agency theory.

Agency theory emphasizes the potential conflicts that arise from the separation of ownership and control, in which managers may pursue their own interests rather than the shareholder's interests and long-term value (Jensen and Meckling, 1979). However, the ownership structure varies in monitoring strength, risk preferences, and ESG performance. Ownership structure may influence how effectively managers are supervised, how ESG commitments are implemented, and how firm risk-taking decisions are aligned with shareholder's interests. As a result, firms with different ownership structures shape how ESG performance influences firm risk-taking decisions and outcomes.

2.2 Hypotheses Development

2.2.1 ESG Performance and Firm Risk-Taking

Firm risk-taking reflects a firm's strategic willingness to undertake activities involving uncertainty but offering potentially higher returns, such as research and development investments, market expansion, and strategic restructuring (Anton et al., 2025). As a core strategic choice, firm risk-taking directly influences innovation, competitiveness, and sustainable growth. In this context, the question of whether ESG performance encourages or limits firm risk-taking remains unresolved in the existing literature (Adardour et al., 2026; Kazancoglu et al., 2021). Two distinct views exist in the literature: a positive view argues that ESG performance encourages firm risk-taking, while a negative view claims that ESG restrains firm risk-taking. The positive perspective suggests that strong ESG performance can lead to increased firm risk-taking because it enhances a firm's ability to engage in risky yet valuable activities. With strong ESG performance, a firm can improve transparency, reduce information gaps, build a better reputation, and gain more trust from investors and creditors. This can result in fewer financing constraints and easier access to external capital (Chen et al., 2021; Peliu, 2024; Sun et al., 2024). Recent studies also indicated that ESG disclosure can significantly alleviate financing constraints, while strong ESG performance can boost firm innovation and technological advancements (Zhang et al., 2024; Wang and Wang, 2024; Xie et al., 2026). This is crucial, as firms with better access to financing, stronger stakeholder support, and enhanced innovation capacity are more likely to invest in long-term activities such as Research and Development (R&D), technological upgrades, and market expansion, which generally involve higher but productive risks (Tan et al., 2024). Hence, ESG can serve as a strategic resource that increases a firm's readiness and ability to take risks that create value (Bai et al., 2022). This positive view aligns with stakeholder theory, which posits that engaging in ESG builds trust and improves access to strategic resources, allowing firms to pursue long-term, value-enhancing risk-taking. On the other hand, the negative view argues that ESG performance may reduce firm risk-taking by promoting stronger governance, increased monitoring, and better transparency (Du and Nik Azman, 2024; Shakil, 2021; Singhania and Gupta, 2024). These factors can limit managerial opportunism and discourage excessive firm risk-taking, as ESG has been shown to lower firm risk-taking through improved information transparency, stronger corporate governance, and increased external monitoring pressure (He et al., 2023). This view aligns with risk management theory, which suggests that incorporating ESG into risk governance helps firms better control downside risks and avoid excessive uncertainty, leading to more conservative strategies and lower risk exposure.

However, this study expects the positive relationship to be stronger because ESG performance can act as a strategic resource by enhancing a firm's reputation, bolstering stakeholder confidence, improving access to capital, and reducing financing constraints. In addition, better ESG performance can foster innovation capability and support long-term investments, including R&D, technological upgrades, and market expansion. Since these activities entail uncertainty but are vital for future growth, firms with

stronger ESG performance are more likely to engage in greater value-enhancing risk-taking. Therefore, this study proposes the following hypothesis:

H1: ESG performance positively influences firm risk-taking.

2.2.2 Ownership Structure, ESG Performance, and Firm Risk-Taking

Ownership structure refers to the distribution of the firm's equity among different categories of shareholders. It represents a fundamental corporate governance mechanism that shapes managerial oversight, strategic decision-making, and risk preferences within a firm. By influencing control rights, monitoring intensity, and incentive alignment, ownership structure plays a crucial role in determining a firm's resource allocation, sustainability orientation, and risk-taking behavior (Acar et al., 2021). Accordingly, prior studies argue that different ownership types directly influence both ESG performance and firm risk-taking. Specifically, certain ownership arrangements promote ESG engagement by encouraging green technological innovation and strengthening disclosure practices (Jakobsen and Johan Berg, 2023; Jia et al., 2022; Zhang and Wu, 2024), while also shaping the firm risk-taking behavior by reinforcing governance mechanisms, enhancing oversight, and strategic risk-taking (Hu et al., 2025; Jha and Tiwari, 2025; Roedder and Schmid, 2026).

Beyond the direct effect of ownership types, a growing body of literature recognizes ownership structure as an important moderating mechanism. However, the moderating role of ownership structure is primarily grounded in agency theory, which emphasizes conflicts of interests and information asymmetry between managers and shareholders. Effective ownership structures strengthen monitoring and align managerial incentives with shareholder's objectives, reducing agency costs and encouraging long-term value creation (Alam et al., 2024). This suggests that ownership structure shapes managerial decisions and strategic orientation, thereby influencing how ESG performance affects firm risk-taking.

Empirical studies provide further support for this theoretical perspective, for example, Song et al. (2015) found that ownership structure moderates the relationship between market orientation and firm innovation performance, while Ishtiaq et al. (2017) showed that it significantly affects the link between CSR and Return on Assets (ROA), similarly, Ali et al. (2019) demonstrated that ownership structure shapes both Corporate Social Reporting Disclosure (CSRD) and its performance implications, a view further supported by Acar et al. (2021), who emphasized its role in driving ESG disclosure in response to growing stakeholder demands for transparency. From a valuation perspective, Wu et al. (2022) highlighted the moderating effect of ownership structure on the relationship between ESG performance and firm value in Chinese manufacturing firms. Extending this evidence, Abidi et al. (2022) revealed that ownership structure influences the interaction between systematic risk and corporate governance in Gulf Cooperation Council countries, while Alsultan and Hussainey (2024) reported that it moderates the association between related party transactions and earnings quality. Prior literature further suggests that different ownership types are likely to differentially affect the effectiveness of ESG performance in influencing firm risk-taking (Jia et al., 2022; Wu et al., 2025; Zhang and Wu, 2024). However, despite its importance, empirical evidence on how ownership structure moderates the relationship between ESG performance and firm risk-taking remains limited, particularly for Chinese non-financial firms. Given China's distinctive institutional environment and heterogeneous ownership arrangements, examining this moderating role is both theoretically and empirically important. Given the importance and the knowledge gap, this study further distinguishes among ownership types to investigate their differential moderating effects and proposes the following hypotheses.

2.2.3 Institutional Ownership

Institutional ownership is generally associated with stronger monitoring incentives, professional expertise, and longer investment horizons, which enhance managerial discipline and reduce agency problems (Bushee, 1998; Shleifer and Vishny, 1986). Prior studies suggest that institutional investors are better able to process non-financial information, such as ESG disclosure, and to pressure managers to integrate sustainability considerations into long-term strategic decision-making rather than engaging in symbolic or opportunistic ESG activities (Dyck et al., 2019; Krüger, 2015). As a result, institutional ownership may influence how ESG performance functions as a risk management mechanism by improving transparency, mitigating information asymmetry, and shaping a firm risk-taking decisions, rather than leading to opportunistic or inefficient risk-taking. Hence, the following hypothesis was proposed:

H2: Institutional ownership moderates the relationship between ESG performance and firm risk-taking.

2.2.4 State Ownership

State ownership influences the relationship between ESG performance and firm risk-taking primarily through policy alignment, political legitimacy, and government oversight, which are particularly salient in emerging economies such as China. State-owned enterprises (SOEs) are often subject to stronger regulatory pressure and social responsibility mandates, which encourage them to adopt ESG practices to maintain legitimacy and comply with national sustainability objectives (Marquis and Qian, 2014). Moreover, state ownership may provide implicit guarantees and preferential access to financing (Boubakri et al., 2013; Fan et al., 2013), which can reduce the financing frictions and uncertainty associated with long-term ESG in-

vestments. As a result, state ownership may influence how ESG performance affects firm risk-taking by strengthening oversight and increasing resource availability. Hence, the following hypothesis was proposed:

H3: State ownership moderates the relationship between ESG performance and firm risk-taking.

2.2.5 Foreign Ownership

Foreign ownership, on the other hand, introduces international governance standards, advanced management practices, and heightened expectations for transparency and disclosure quality. Foreign investors typically demand higher-quality ESG reporting and stronger investor protection mechanisms, thereby constraining managerial discretion and limiting opportunistic behavior (Gul et al., 2010). Prior evidence suggests that foreign ownership improves the information environment by reducing information asymmetry and enhancing disclosure credibility (Leuz et al., 2009), thereby strengthening the value of ESG performance and improving external stakeholder's confidence. In this context, foreign ownership may influence how ESG engagement affects firm risk-taking by shaping governance discipline, encouraging quality, and promoting a strategic orientation in the firm risk-taking decisions. Hence, the following hypothesis was proposed:

H4: Foreign ownership moderates the relationship between ESG performance and firm risk-taking.

3. Methodology

3.1 Data and Sampling

The study used the data for Chinese non-financial firms for the period 2015 to 2024 to empirically validate the hypotheses. The exclusion of financial firms is consistent with earlier studies that focus on ESG performance (Eliwa et al., 2021; Guidara et al., 2014; Xu et al., 2021). We have excluded financial firms for several reasons. For instance, stakeholders pressure on non-financial firms regarding environmentally safe and socially responsible business operations differs from that on financial firms. Non-financial firms also face challenges, such as modernizing technology and sourcing raw materials, which can influence their ESG practices. Conversely, financial firms possess distinct features and face different challenges. Additionally, the business operations of non-financial firms directly impact society and the environment; hence, complying with environmental regulations becomes more crucial for them than for their counterparts (Liu et al., 2024; Sheikh, 2019; Van Duuren et al., 2016). Moreover, there are several reasons for choosing the Chinese non-financial firms as a context of study. First, China has introduced significant ESG-related reforms and disclosure requirements, making it a relevant context for analysis. Second, China has a unique diversity in the ownership structures. Third, rapid economic growth, alongside environmental and social challenges, underscores the importance of understanding ESG performance and a firm risk-taking in China.

The final dataset is unbalanced, comprising 25,686 firm-year observations. This study utilized Huazheng ESG scores retrieved from the Wind database, consistent with (Cai et al., 2023; Chen and Fan, 2024). Furthermore, data on other variables were extracted from the China Stock Market Accounting Research (CSMAR) database, one of the most widely used databases in Chinese literature (Abdullah et al., 2024; Ma and Cao, 2023). These databases are considered reliable for financial and non-financial data. Furthermore, to enhance the reliability of our estimates and remove outliers, we winsorized continuous variables at the 5% and 95% level.

3.2 Dependent Variables

This study uses a variety of firm risk-taking measures as dependent variables, consistent with prior literature that uses multiple proxies to measure firm risk-taking (He et al., 2023; Mihet, 2013; Widianingsih et al., 2023; Zheng et al., 2023). Therefore, we used four proxies to measure firm risk-taking: the Cash Asset Ratio (CA), R&D investment (ln_RD), Innovation Intensity (Inn_In), and the standard deviation of adjusted ROA (SD_ROA). A higher cash asset ratio reflects a firm's capacity to take on more risk. Therefore, we measured cash assets as the total cash and cash equivalents at the end of each year, to the firms total assets in the same period (Gopalan et al., 2021; He et al., 2023). In addition, ln_RD is measured as natural logarithm of the ratio of R&D expenditure to market capitalization following Mihet (2013), while Inn_In measures innovation intensity as R&D expenditure divided by operating revenue, following Widianingsih et al. (2023). Although both variables are derived from a firm's R&D expenditure, they capture different aspects of risk-taking. ln_RD reflects the firm's R&D investment commitment from a market-based perspective, whereas Inn_In captures innovation intensity relative to operating scale. Therefore, retaining both variables allows us to capture more effectively the different dimensions of innovation-related firm risk-taking, thereby enhancing robustness. Lastly, following prior literature, we measure the standard deviation of adjusted ROA over a rolling three-year period; greater volatility indicates higher risk-taking and vice versa. This measure captures a firm's strategic willingness to undertake risky, value-enhancing investments to pursue higher future returns (Boubakri et al., 2013; Faccio et al., 2011; John et al., 2008).

3.3 Independent Variables

This study used ESG performance as an independent variable. To measure a firm's ESG performance, we used Huazheng ESG scores extracted from the Wind database, consistent with Li et al. (2024) and Zhu and Yang (2024). Prior literature suggests that the Huazheng scores from the Wind database include internationally acceptable structures with unique features of the Chinese capital markets and cover a large number of listed companies. It offers comprehensive coverage and regular updates (Deng et al., 2023).

3.4 Moderating Variables

In this study, we treat ownership structure as a moderating variable and measure it using three types of ownership: institutional ownership (INO), state ownership (STO), and foreign ownership (FO). Institutional ownership is calculated as the percentage of shares held by institutional investors to total outstanding shares (Qu and Zhang, 2023). Furthermore, STO is measured by focusing on the top ten shareholders to the total outstanding shares, which provides a clearer indication of state influence (Qian and Yang, 2023). Similarly, foreign ownership is measured as the share held by the top ten foreign shareholders to the total outstanding shares (Guo and Zheng, 2021).

3.5 Control Variables

This study has used Executive pay, firm growth, firm size, return on equity, debt-to-equity, and fixed assets as control variables consistent with prior literature. Executive pay (Pay) is measured as the natural logarithm of the executive pay, excluding allowances (Wu et al., 2022), and firm growth (Growth) is measured as the ratio of the change in current year's operating revenue to last year's operating revenue (Hong et al., 2024). Further, firm size (Fsize) is measured through the natural logarithm of total assets at the end of the year (Atan et al., 2018; Qu and Zhang, 2023). Moreover, return on equity (ROE) is calculated by dividing the ratio of net profit by average shareholder's equity, consistent with Guo and Zheng (2021), and the fixed assets ratio (Fix) is measured by a ratio of fixed assets to total assets, consistent with Liu and Lee (2024). Lastly, the debt-to-equity is measured as the ratio of the total liabilities to total equity (Khorilov and Kim, 2024). Table 1 presents the variable names, types, symbols, and descriptions used in the study.

3.6 Statistical Analysis and Model Specifications

This study employed two statistical techniques to test our hypotheses empirically. First, we used a fixed-effects (FE) model for our estimation, which is a widely used statistical method in the finance literature (Wu et al., 2025; Wu et al., 2022). To determine whether to use a fixed-effects or random-effects model, we conducted the Hausman test, which indicated that the fixed-effects model was appropriate. Previous literature suggests that the fixed-effects model effectively controls unobserved heterogeneity and cross-sectional dependence (Le and Tran-Nam, 2018). Second, to cross-validate the results from the fixed-effects model, we used feasible generalized least squares (FGLS) regression. This method is well known for addressing issues of autocorrelation and heteroscedasticity (Greene, 1997). Additionally, FGLS allows consistent estimation of a large error covariance matrix, an advantage over ordinary least squares (OLS) regression with robust standard errors. Before performing the final statistical analysis, we conducted diagnostic tests for multicollinearity, structural breaks, non-normality, heteroscedasticity, and autocorrelation to ensure that the necessary assumptions were met. To justify the model, we follow the panel econometric framework commonly used in studies examining firm risk-taking and ESG performance. For example, Menla Ali et al. (2024) estimate the effect of ESG disclosure on firm risk-taking using a panel fixed-effects model with firm-level controls; similarly, Sun et al. (2024) analyze ESG components and firm risk among A-share firms using fixed-effects specifications. Following prior literature, we examine model 1 to estimate the baseline effect of ESG performance on firm risk-taking and empirically validate H1. Model 1 (Eqn. 1) is presented below:

$$\begin{aligned} FR_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 \text{Pay}_{i,t} + \beta_3 \text{Growth}_{i,t} \\ + \beta_4 \text{Size}_{i,t} + \beta_5 ROE_{i,t} + \beta_6 \text{Lev}_{i,t} \\ + \beta_7 \text{Fix}_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

However, before testing moderation effects, as recommended in the moderation literature, we first estimated the direct impact of ownership structure on firm risk-taking to ensure proper model specification and facilitate the interpretation of the interaction terms (Aiken et al., 1991; Baron and Kenny, 1986). Accordingly, models 2–4 were estimated to examine the baseline effect of institutional, state, and foreign ownership on firm risk-taking. For brevity, we only present model 2 (Eqn. 2) below, while INO is replaced by STO and FO in models 3 and 4, respectively.

$$\begin{aligned} FR_{i,t} = \beta_0 + \beta_1 INO_{i,t} + \beta_2 \text{Pay}_{i,t} + \beta_3 \text{Growth}_{i,t} \\ + \beta_4 \text{Size}_{i,t} + \beta_5 ROE_{i,t} + \beta_6 \text{Lev}_{i,t} \\ + \beta_7 \text{Fix}_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

To examine whether ownership structure moderates the relationship between ESG performance and firm risk-taking, we estimate interaction models by incorporating multiplicative terms between ESG performance and ownership variables. This interaction-based specification is the standard approach for testing moderating effects in regression models and is widely adopted in empirical research (Aiken et al., 1991; Baron and Kenny, 1986; Dawson, 2014). Prior studies have shown that different types of ownership structures play an important role in shaping ESG performance and corporate governance outcomes (Jia et al., 2022; Villalonga et al., 2025; Zhang and Wu, 2024). Empirical evidence on how different types of ownership structures affect the relationship between ESG performance and firm risk-taking remains limited. Accordingly, models 5–7 were estimated to empirically validate H2–H4. These hypotheses will be supported if the interaction terms (i.e., ESG × INO, ESG × STO, and ESG × FO) are statistically significant. For brevity, only model 5 (Eqn. 3) is presented below.

Table 1. Description of variables.

Variable name	Type	Symbols	Description
ESG Performance	Independent	ESG	Huazheng ESG scores from the Wind Database.
Cash Asset Ratio	Dependent	CA	Ratio of cash and cash equivalents to total assets.
R&D Investment	Dependent	ln_RD	Natural logarithm of the ratio of R&D expenditure to market capitalization.
Innovation Intensity	Dependent	Inn_In	Ratio of R&D expenditure to operating revenue.
Standard Deviation of Adjusted ROA	Dependent	SD_ROA	Standard deviation of adjusted ROA over a rolling three-year period (adjusted by industry-year average).
Institutional Ownership	Moderating	INO	The percentage of shares held by institutional shareholders to total outstanding shares.
State Ownership	Moderating	STO	The percentage of shares held by state-owned shareholders among the top ten shareholders to total outstanding shares.
Foreign Ownership	Moderating	FO	The percentage of shares held by foreign shareholders among the top ten shareholders to total outstanding shares.
Executive Pay	Control	Pay	Natural logarithm of executive pay, excluding allowances.
Firm Growth	Control	Growth	Ratio of the change in current year's operating revenue to last year's operating revenue.
Firm Size	Control	Fsize	Natural logarithm of total assets at the end of the year.
Return on Equity	Control	ROE	Ratio of net profit to average shareholder's equity.
Debt-to-Equity	Control	Lev	Ratio of total liabilities to total equity.
Fixed Assets	Control	Fix	Ratio of fixed assets to total assets.

Note: ESG, Environmental, Social, and Governance; R&D, Research and Development; ROA, Return on Assets.

In models 6 and 7, INO is replaced by STO and FO, respectively.

$$FR_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 INO_{i,t} + \beta_3 ESG \times INO_{i,t} + \beta_4 \text{Pay}_{i,t} + \beta_5 \text{Growth}_{i,t} + \beta_6 \text{Size}_{i,t} + \beta_7 ROE_{i,t} + \beta_8 \text{Lev}_{i,t} + \beta_9 \text{Fix}_{i,t} + \varepsilon_{i,t} \quad (3)$$

4. Discussion of Results

4.1 Descriptive Statistics and Correlation Matrix

The descriptive statistics of all variables used in the study are presented in Table 2. The results suggest that the mean value and standard deviation of ESG are 73.196 and 5.911, respectively (Ding et al., 2024). Notably, ESG is retained in its original score form, following the prior literature (Chen and Fan, 2024; Fu, 2024). Furthermore, the mean value of CA is 0.152, with a standard deviation of 0.110, consistent with He et al. (2023) for Chinese firms. Moreover, the mean values of ln_RD, Inn_In, and SD_ROA are 17.086, 6.182, and 0.011, respectively. Furthermore, Table 2 shows that the mean values of INO, STO, and FO are 0.403, 0.448, and 0.053, respectively. Table 2 also reports the Shapiro-Wilk statistics; all values are statistically significant, indicating that the variables are not normally distributed. Additionally, the Variance Inflation Factor (VIF) scores reported in Table 2 indicate that the variables do not suffer from multicollinearity, as all VIF values are less than 5 (Myers, 1990).

Table 3 reports the Pearson correlation matrix for the variables used in this study. All values are below 0.8; therefore, the variables do not exhibit multicollinearity (Gujarati, 1995).

4.2 Panel Regression Results and Discussion

Tables 4,5 present the baseline and interaction results from the fixed-effects (FE) models. The results reported in Table 4 indicate that ESG performance is positively and significantly associated with all the proxies used to measure firm risk-taking (i.e., CA, ln_RD, Inn_In, and SD_ROA). The positive coefficient on ESG suggests that firms with strong ESG commitments are more likely to maintain higher cash reserves and prioritize long-term value through strategic investments in R&D and innovation (Sun et al., 2024). The greater the volatility in operating returns, the higher the firm risk-taking (Dai and Wang, 2024). This finding is consistent with stakeholder theory, which argues that firms with better ESG practices build trust and long-term relationships with stakeholders, thereby reducing uncertainty and encouraging greater risk-taking (Freeman, 2010), as well as with agency theory, which suggests that stronger governance and transparency associated with ESG engagement reduce agency costs, enabling managers to align investment decisions with stakeholder interests better and undertake value-engaging but riskier projects (Fama and Jensen, 1983).

However, the positive association also aligns with prior literature showing that higher ESG commitments and stakeholder support are associated with greater risk-taking (Du and Nik Azman, 2024; Sun et al., 2024). This implies that ESG performance influences a firm risk-taking profiles by providing greater financial flexibility, higher R&D investment, stronger commitment to innovation projects, and, in turn, greater risk-taking, as reflected in higher earnings volatility (Liao and Jesmin, 2023; Sun et al., 2024). Together, these findings confirm that ESG engagement encourages firms to take on greater overall risk. Hence, we find support for H1.

While prior studies report mixed evidence on the relationship between ESG performance and firm risk-taking, our analysis

Table 2. Descriptive statistics.

	Mean	Standard Deviation	Minimum	Maximum	Shapiro-Wilk Statistics	VIF
ESG	73.196	5.911	50	100	0.989***	1.29
CA	0.152	0.110	0	0.906	0.862***	_
ln_RD	17.086	2.132	5.667	21.420	0.992***	_
Inn_In	6.182	6.467	0.030	51.51	0.755***	_
SD_ROA	0.011	0.022	0.000	0.120	0.598***	_
INO	0.403	0.240	0	0.999	0.703***	1.61
STO	0.448	0.245	0.000	0.865	0.928***	1.64
FO	0.053	0.125	0	0.913	0.494***	1.49
Pay	6.480	7.595	0.139	18.756	0.661***	1.16
Growth	0.019	0.208	–0.589	18.783	0.476***	1.07
Fsize	22.460	1.325	18.122	31.519	0.952***	1.80
ROE	0.052	0.092	–0.192	0.202	0.776***	1.29
Lev	0.012	0.025	0.000	0.999	0.294***	1.31
Fix	0.196	0.138	0.000	0.938	0.933***	1.03

Note: *** indicates the statistical significance at the 1% level. VIF, Variance Inflation Factor.

offers a more nuanced economic interpretation, showing that ESG engagement positively affects firm risk-taking, suggesting it can strategically promote risk-taking rather than merely mitigate it in the Chinese context. Specifically, ESG-oriented firms tend to allocate resources to long-term investments such as innovation, green technologies, and organizational restructuring, which inherently involve greater uncertainty, higher earnings volatility, and delayed returns. In this context, increased risk-taking refers to intentional, strategic risk-taking aimed at enhancing long-term competitiveness, rather than excessive or destabilizing behavior.

Furthermore, Table 4 reports baseline results estimating the impact of INO, STO, and FO on firm risk-taking. The results suggest that INO is positively and significantly associated with all proxies of firm risk-taking. This implies that the presence of INO can lead to enhanced governance mechanisms, better cash management to navigate risk, and the ability to seize opportunities (Jiang et al., 2021). Furthermore, INO focuses on long-term investments rather than short-term return and earnings, hence increasing R&D investment and innovation intensity (Edacherian et al., 2024). Therefore, in the presence of INO firms invest more in long-term projects than short-term investments (Neubauer and Blomberg Persson, 2023). Such long-term-oriented investment strategies may also generate short-term fluctuations, as reflected in the higher variability of adjusted ROA, which captures intentional, value-enhancing risk-taking rather than excessive, destabilizing behavior (Sakawa et al., 2021).

The results reported in Table 4 also suggest that STO is significantly associated with all the firm risk-taking proxies. The positive and significant association with CA is consistent with Nguyen Thi et al. (2023), arguing that STO firms retain more cash to mitigate unforeseen events arising from financial instability, government influence, and constraints. The results also suggest that firms with high STO allocate more resources to R&D activities and innovation projects, consistent with Zeng and Lin (2011). In addition, the negative and significant association between STO and SD_ROA indicates that higher state ownership is associated with lower earnings volatility. This pattern is consistent with prior literature suggesting that governments tend to prioritize employment stability and political objectives over profit maximization, which may limit incentives to engage in high-risk activities that affect earnings uncertainty (Boubakri et al., 2013).

Lastly, the results reported in Table 4 suggest that FO is positively and significantly related to CA, ln_RD, and SD_ROA, while, its association with Inn_In is statistically insignificant. These findings imply that firms with FO maintain stronger cash positions to enhance financial flexibility and liquidity management, which, in turn, may facilitate greater investment in R&D and support long-term investment initiatives. This long-term investment orientation may also lead to greater variability in SD_ROA, as foreign owners are more willing to undertake innovative, riskier projects with uncertain short-term returns. Furthermore, FO may help reduce agency conflicts, strengthened governance mechanisms, and active involvement in introducing new technologies, potentially supporting higher Inn_In and a greater willingness to undertake risky long-term projects, consistent with Lee and Yang (2016). Moreover, these findings are consistent with the view that foreign owners tend to undertake risky projects, as they expect such investments to yield superior long-term returns and to incentivize managers to operate firms more efficiently (Subastian and Setiawan, 2022).

Furthermore, this study contributes to the literature by demonstrating that the relationship between ESG and firm risk-taking is not uniform and is significantly shaped by ownership structure. Institutional, state, and foreign owners differ in their monitoring capacity, investment horizon, and risk tolerance, thereby influencing how ESG initiatives affect firm risk-taking decisions. This helps explain why prior studies report mixed findings, since the effect of ESG varies with a firm's governance and ownership structures. Our results generally support the view that ESG performance positively influences firm risk-taking. These findings offer economic insight into ESG as a governance-driven mechanism that actively influences a firm's strategic risk-taking decisions rather than functioning solely as a risk-reducing tool. Hence, a diverse ownership structure encourages firms to under-

Table 3. Correlation matrix.

	ESG	CA	ln_RD	Inn_In	SD_ROA	INO	STO	FO	Pay	Growth	Fsize	ROE	Lev	Fix
ESG	1.000													
CA	0.111***	1.000												
ln_RD	0.230***	–0.083***	1.000											
Inn_In	0.036***	0.160***	0.109***	1.000										
SD_ROA	–0.139***	0.091***	–0.451***	0.205***	1.000									
INO	0.177***	–0.014**	0.251***	–0.132***	–0.205***	1.000								
STO	0.023***	0.118***	–0.529***	0.095***	0.124***	–0.089***	1.000							
FO	0.133***	0.014	0.241***	–0.010	–0.079	0.247***	–0.437***	1.000						
Pay	0.241***	0.049***	0.121***	0.100***	0.071***	0.208***	0.035***	0.125***	1.000					
Growth	0.002	0.018***	–0.057***	0.001	–0.038	0.019***	0.048***	0.020**	0.061***	1.000				
Fsize	0.320***	–0.191***	0.459***	–0.143***	–0.209***	0.477***	–0.155***	0.133***	0.440***	–0.004	1.000			
ROE	0.242***	0.150***	0.208***	–0.162***	–0.312***	0.198***	0.079**	0.125***	0.183***	0.124***	0.176***	1.000		
Lev	–0.097***	–0.169***	0.003	–0.020***	0.044**	0.065***	–0.060***	–0.010	0.032***	0.007	0.217***	–0.119***	1.000	
Fix	–0.057***	–0.292***	–0.018	–0.211***	–0.003	0.098***	–0.013	0.006	–0.048***	–0.012**	0.061***	–0.040***	–0.003	1.000

Note: *** and ** indicate statistical significance at 1% and 5% levels, respectively.

Table 4. Baseline regression results using the fixed effects model (FE).

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	CA	CA	CA	CA	ln_RD	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA	SD_ROA
ESG	0.0007***				0.0037*				0.0145***				0.0182***			
	(0.0001)				(0.0021)				(0.0043)				(0.0031)			
INO		0.0001***				0.0511***				0.0086***				0.0337***		
		(0.0000)				(0.003)				(0.0010)				(0.0007)		
STO			0.0162***				0.0506***				0.0131***				–3.4125***	
			(0.0048)				(0.0003)				(0.0019)				(0.1521)	
FO				0.0498***				0.0587***				1.1261				0.0004***
				(0.0182)				(0.0010)				(0.7614)				(0.0000)
Pay	–0.0001	–0.0019*	–0.0150***	–0.0192***	–0.7903***	–0.1981***	–0.0562***	–0.1511***	0.4614***	0.3613***	0.1888***	0.2069***	0.6770***	0.3315***	–0.2705***	–0.0037***
	(0.0011)	(0.0010)	(0.0017)	(0.0019)	(0.0221)	(0.0126)	(0.0140)	(0.0194)	(0.0435)	(0.0445)	(0.0701)	(0.0813)	(0.0324)	(0.0308)	(0.0437)	(0.0000)
Growth	–0.0062***	0.0000***	–0.0000***	–0.0001***	–0.0034***	–0.0011***	–0.0007***	0.0003	–0.0124***	–0.0140***	–0.0099***	–0.0170***	–0.0022***	–0.0027***	–0.0001	–0.0005
	(0.0024)	(0.0000)	(0.0000)	(0.0000)	(0.0004)	(0.0003)	(0.0002)	(0.0003)	(0.0000)	(0.0009)	(0.0009)	(0.0013)	(0.0006)	(0.0005)	(0.0006)	(0.0008)
Fsize	–0.0133***	–0.0134***	–0.0171***	–0.0066*	0.0867***	0.8072***	0.8137***	–0.1423***	–0.0775	–0.1391***	–0.0826	0.2161	0.4751***	–0.2386***	–0.1439*	–0.0078***
	(0.0013)	(0.0013)	(0.0029)	(0.0039)	(0.0262)	(0.0182)	(0.0240)	(0.0397)	(0.0540)	(0.0557)	(0.1204)	(0.1638)	(0.0416)	(0.0416)	(0.0853)	(0.0012)
ROE	0.0507***	0.1039***	0.0611***	0.1092***	1.4747***	0.7003***	0.2764***	0.7805***	–7.1789***	–3.4280***	–3.2823***	–6.6341***	–3.5456***	–2.9351***	–3.6618***	–0.0467***
	(0.0040)	(0.0067)	(0.0085)	(0.0146)	(0.0816)	(0.0558)	(0.0703)	(0.0969)	(0.2736)	(0.1694)	(0.3416)	(0.6071)	(0.1378)	(0.1288)	(0.2237)	(0.0025)
Lev	–0.2719***	–0.3227***	–0.0085	–0.0375	–3.7155***	–5.3690***	–4.8278***	1.2629	0.2766	–1.6081	–15.9763***	–16.6176***	5.5143***	6.8682***	–3.3953	–0.1276***
	(0.0444)	(0.0438)	(0.1097)	(0.1299)	(0.9194)	(0.6242)	(0.9805)	(1.5943)	(1.7929)	(1.8174)	(4.3917)	(5.3886)	(1.5913)	(1.4756)	(2.8708)	(0.0347)
Fix	–0.2259***	–0.2263***	–0.2525***	–0.2351***	–1.9317***	–0.9465***	–0.5909***	–1.0186***	–0.6247*	–0.3936	0.6596	0.1283	0.3375	0.2772	–0.8816**	–0.0141***
	(0.0083)	(0.0083)	(0.0160)	(0.0186)	(0.1641)	(0.1119)	(0.1249)	(0.1827)	(0.3405)	(0.3414)	(0.6416)	(0.7734)	(0.2638)	(0.2453)	(0.4094)	(0.0048)
Constant	0.4465***	0.5257***	0.8224***	0.6543***	27.8960***	2.9587***	0.7154	21.2878***	0.2049	3.8184***	5.5491**	–0.0933	–20.892***	1.0534	8.5232***	–0.0878***
	(0.0271)	(0.0292)	(0.0648)	(0.0846)	(0.5388)	(0.3955)	(0.5212)	(0.8501)	(1.1156)	(1.2099)	(2.6094)	(3.5145)	(0.8442)	(0.9181)	(1.8426)	(0.0258)
F–Statistic	179.02***	186.69***	77.39***	70.61***	306.24***	3825.09***	2779.05***	524.47***	157.12***	130.54***	49.54***	56.52***	265.49***	581.93***	147.97***	94.07***
Within R^2	0.0601	0.0626	0.0734	0.0776	0.1003	0.5821	0.7496	0.3983	0.0536	0.0449	0.0484	0.0631	0.1279	0.2433	0.1437	0.1073
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 5. Interaction results using the fixed effects model (FE).

	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7
	CA	CA	CA	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA
ESG	0.0004***	0.0000	0.0003**	0.0048***	–0.0042	–0.0026	0.0148***	0.0280**	0.0061	0.0318***	0.0506***	0.0190***
	(0.0001)	(0.0002)	(0.0001)	(0.0014)	(0.0027)	(0.0022)	(0.0044)	(0.0114)	(0.0072)	(0.0030)	(0.0085)	(0.0044)
INO	0.0000			0.0513***			0.0075***			0.0351***		
	(0.0000)			(0.0003)			(0.0010)			(0.0007)		
STO		0.0007*			5.9410***			0.0422**			–0.0869***	
		(0.0004)			(0.4086)			(0.0174)			(0.0123)	
FO			0.0003***			1.4489			3.6019**			0.0568***
			(0.0001)			(1.1303)			(1.6335)			(0.0041)
ESG × INO	0.0004***			0.0331***			0.0048*			0.0427***		
	(0.0000)			(0.0009)			(0.0029)			(0.0002)		
ESG × STO		0.0010**			0.0134**			0.0399*			0.0718***	
		(0.0005)			(0.0054)			(0.0236)			(0.0165)	
ESG × FO			0.0008***			0.0433***			0.0523*			0.0535***
			(0.0002)			(0.0146)			(0.0299)			(0.0111)
Pay	–0.0016	–0.0121***	–0.0167***	–0.2034***	–0.0294*	–0.2407***	0.3888***	0.2316***	0.2380***	0.3047***	–0.2262***	–0.3357***
	(0.0011)	(0.0018)	(0.0020)	(0.0150)	(0.0164)	(0.0246)	(0.0446)	(0.0711)	(0.0845)	(0.0307)	(0.0449)	(0.0523)
Growth	–0.0000***	–0.0000***	–0.0001***	–0.1169***	–0.1206***	–0.0864**	–0.0128***	–0.0099***	–1.7064***	–0.0025***	0.0004	–0.0004
	(0.0000)	(0.0000)	(0.0000)	(0.0327)	(0.0230)	(0.0426)	(0.0009)	(0.0009)	(0.1393)	(0.0005)	(0.0006)	(0.0008)
Fsize	–0.0164***	–0.0200***	–0.0119***	0.7768***	0.7045***	–0.6103***	–0.1823***	–0.1192	0.1886	–0.2858***	–0.2389***	–0.5807***
	(0.0014)	(0.0030)	(0.0043)	(0.0178)	(0.0271)	(0.0479)	(0.0561)	(0.1217)	(0.1660)	(0.0415)	(0.0851)	(0.1245)
ROE	0.0556***	0.0624***	–0.0533***	0.4919***	0.7404***	2.3659***	–6.8918***	–3.2861***	–6.5245***	–2.6887***	–6.1616***	–4.5851***
	(0.0045)	(0.0086)	(0.0098)	(0.0543)	(0.1185)	(0.1778)	(0.2777)	(0.3427)	(0.6101)	(0.1277)	(0.3404)	(0.2529)
Lev	–0.2624***	0.0206	–0.0757	–4.5761***	–4.5756***	1.8713	0.2834	–15.1612***	–15.9851***	6.9533***	5.8083**	–10.9861***
	(0.0484)	(0.1118)	(0.1411)	(0.6055)	(1.048)	(1.8492)	(1.7924)	(4.4150)	(5.4228)	(1.4580)	(2.7218)	(3.4951)
Fix	–0.2452***	–0.2442***	–0.2375***	–0.7191***	–0.6882***	–1.2352***	–0.7996**	0.2358	0.4580	0.2358	–1.0807***	–1.5025***
	(0.0090)	(0.0157)	(0.0191)	(0.1084)	(0.1405)	(0.2241)	(0.3415)	(0.6238)	(0.7813)	(0.2417)	(0.4109)	(0.4887)
Constant	0.5520***	0.8422***	0.7106***	3.0466***	3.0065***	33.1517***	3.6995***	3.7289	–0.5272	1.4448	–6.3041***	–6.1332**
	(0.0323)	(0.0690)	(0.0918)	(0.3898)	(0.6145)	(1.0106)	(1.2177)	(2.7408)	(3.5174)	(0.9108)	(1.9256)	(2.6591)
F–Statistic	146.18***	60.80***	49.64***	3344.48***	1683.32***	84.16***	127.95***	39.17***	44.01***	521.30***	127.9***	78.34***
Within R^2	0.0631	0.0745	0.0711	0.6107	0.7010	0.1209	0.0561	0.0495	0.0636	0.2708	0.1574	0.1184
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

take riskier yet potentially value-enhancing activities, ultimately amplifying overall firm risk-taking. Table 4 also reports the coefficients of control variables used in the study. The signs of the majority of the control variable coefficients are consistent with the prior literature (Hong et al., 2024; Liu and Lee, 2024).

Table 5 presents the results of the interaction models used to validate H2–H4 empirically. The variable of interest in these models are the interaction terms (i.e., ESG × INO, ESG × STO, and ESG × FO). The results suggest that INO, STO, and FO positively moderate the relationship between ESG performance and firm risk-taking. The results are novel and provide new evidence that ownership structure moderates the relationship between ESG performance and firm risk-taking. However, several prior studies have reported the importance of ownership structure in strategic decision-making and risk management of firms (Alshirah and Alshira'h, 2024; Dakhli, 2021; Usman et al., 2017). Each ownership structure acts differently; for instance, institutional investors help reduce agency conflicts and align managers with sustainable, value-enhancing risk-taking goals. State ownership pushes firms towards ESG compliance and shaping a cautious approach to firm risk-taking. Foreign ownership introduces international governance standards and best practices, thereby enhancing transparency (Huang et al., 2023; Jha and Tiwari, 2025).

However, the results can be interpreted as follows. First, INO positively moderates the relationship between ESG performance and firm risk-taking, as measured by all firm risk-taking proxies. This suggests that INO enhances the role of ESG, leading to prudent cash management strategies and increased investment in R&D projects, ultimately encouraging more firm risk-taking, consistent with agency theory, which posits that INO plays an important role in monitoring firm risk-taking (Sakawa et al., 2021).

Moreover, the significant positive moderation effect on Inn_In indicates that INO strengthens the positive relationship between ESG performance and Inn_In. This implies that ESG-oriented firms are willing to undertake innovation-related risk-taking, possibly because INO provides stronger monitoring, strategic discipline, and long-term support for ESG-oriented investment decisions. Furthermore, the significant positive moderation on SD_ROA indicates that ESG performance, when reinforced by INO, is associated with higher earnings volatility. This suggests value-enhancing risk-taking arising from ESG-driven long-term investments and strategic adjustments. However, the combined effect of ESG performance and institutional ownership increases cash reserves, intensifies investment in R&D innovation, and increases the firm's short-term earnings-based risk-taking behavior.

Second, the moderating effect of STO remains positive and significant across all models using different proxies of firm risk-taking. This implies that firms with higher state ownership tend to maintain higher cash reserves. Furthermore, the results indicate that STO positively and significantly moderates the relationship with ln_RD, indicating that STO materially influences ESG-driven R&D expenditures. In contrast, higher STO positively and significantly strengthens the effect of ESG performance on innovation intensity, indicating that ESG initiatives in STO firms are more effectively translated into realized innovation. This finding is consistent with Azzam and Alhababsah (2022), reporting that STO often fosters investment in sustainable-oriented innovation through government influence and policy support. However, the significant effect on SD_ROA suggests that while STO supports long-term and policy-driven investments, it significantly shapes earnings volatility, reflecting the government's influence on firm risk-taking behavior and financial outcomes. Hence, the results indicate that ESG commitments, when aligned with government oversight, push firms to take a stronger role in long-term investments, maintain higher cash levels, and allocate more resources to innovation, thereby increasing a firm risk-taking capacity. While also reflecting state influence over R&D investment and earnings volatility.

Third, FO positively moderates the relationship between ESG performance and firm risk-taking across all the models of firm risk-taking proxies. The results indicate that foreign investors encourage firms to maintain high cash reserves, invest more in R&D, and engage in other innovative activities. This may stem from foreign investor's preference for long-term growth, global competitiveness, and enhanced ESG-driven innovation strategies, thereby enhancing financial flexibility and strategic investment capacity. Moreover, the effect on SD_ROA indicated that FO amplifies the earnings volatility arising from ESG-related strategic investments, suggesting a greater tolerance for short-term performance fluctuations in pursuit of innovation, global expansion, and long-term competitiveness. Furthermore, this reflects how foreign investor's sustainability preferences encourage firms to pursue ambitious and risky innovation strategies and strong liquidity positions, resulting in higher earnings variability, eventually increasing the risk-taking behavior of firms (Boubakri et al., 2013; Kim, 2025; Lopez-de-Silanes et al., 2024). Consequently, we find support for H2, H3, and H4.

4.3 Robustness Test: Alternative Statistical Technique

To cross-validate the results of the FE models, we employed feasible generalized least squares (FGLS) estimation, which has been widely used in the literature (Abdullah et al., 2024; Naeem et al., 2021). The results are reported in Tables 6,7. The use of FGLS further strengthens the robustness of our analysis. Most results corroborate the findings of the baseline and interaction models in Tables 4,5, further strengthening the reliability of our statistical estimates and our contribution to the existing literature.

5. Further Analyses

5.1 Endogeneity

The review of existing literature suggests that panel datasets may be subject to endogeneity, which may affect the reliability of the results. To mitigate these concerns, this study employs an instrumental variable approach using Two-Stage Least Squares (2SLS) and Two-Step Generalized Method of Moments (GMM) (Khatib, 2025; Lin et al., 2024). The use of both techniques enables us to address the possible endogeneity reported in Tables 8,9,10,11 and cross-validate our main results. We have used the industry average and lagged values of ESG performance as instruments in baseline and interaction models, consistent with prior literature (He et al., 2023; Sun et al., 2024). For models examining the direct effects of ownership structure, institutional, state, and foreign ownership are instrumented with their respective industry averages and lagged values, following the previous literature (Leary and Roberts, 2014; Mi, 2023; Wei et al., 2024). The 2SLS approach is particularly suitable for addressing simultaneity and reverse causality between ESG performance and firm risk-taking. The 2SLS method is transparent and effective at correct-

Table 6. Baseline regression results using feasible generalized least squares (FGLS).

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	CA	CA	CA	CA	ln_RD	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA	SD_ROA
ESG	0.0021***				0.0303***				0.1053***				0.0055**			
	(0.0001)				(0.0023)				(0.0071)				(0.0028)			
INO		0.0003***				0.0536***				0.0364***				0.0302***		
		(0.0000)				(0.0004)				(0.0016)				(0.0006)		
STO			0.0002***				0.0354***				0.0236***				–0.0150***	
			(0.0000)				(0.0005)				(0.0025)				(0.0009)	
FO				0.0003***				0.0034***				0.0128**				0.0065***
				(0.0001)				(0.0012)				(0.0060)				(0.0021)
Pay	0.0140***	0.0130***	0.0111***	0.0138***	–0.2764***	0.1503***	0.1909***	0.3432***	1.5204***	1.3349***	1.3235***	1.2628***	0.7073***	0.4458***	0.3186***	0.1978***
	(0.0010)	(0.0010)	(0.0016)	(0.0017)	(0.0181)	(0.0147)	(0.0199)	(0.0221)	(0.0557)	(0.0565)	(0.0921)	(0.1012)	(0.0235)	(0.0228)	(0.0342)	(0.0367)
Growth	–0.0000	–0.0001***	–0.0001***	–0.0165***	–0.0066***	–0.0015***	–0.0001	–0.0002	0.0014	–0.0030*	–0.0012	0.0002	–0.0990	–0.3307***	–0.0029***	–0.0040***
	(0.0000)	(0.0000)	(0.0000)	(0.0045)	(0.0006)	(0.0004)	(0.0045)	(0.0005)	(0.0018)	(0.0018)	(0.0020)	(0.0026)	(0.0672)	(0.0637)	(0.0007)	(0.0009)
Fsize	–0.0206***	–0.0185***	–0.0172***	–0.0196***	0.8668***	0.9508***	0.7242***	0.6333***	–1.0512***	–0.9704***	–0.4887***	–0.4518***	–0.4555***	–0.5340***	–0.3955***	–0.3547***
	(0.0006)	(0.0062)	(0.0008)	(0.0009)	(0.0120)	(0.0092)	(0.0113)	(0.0124)	(0.0358)	(0.0345)	(0.0492)	(0.0537)	(0.0147)	(0.0134)	(0.0181)	(0.0192)
ROE	0.1031***	0.1207***	0.1334***	0.1421***	1.3877***	0.9316***	0.8061***	0.5450***	–7.1132***	–6.0669***	–7.7855***	–7.6164***	–4.5217***	–4.1935***	–5.5990***	–5.4485***
	(0.0052)	(0.0052)	(0.0080)	(0.0085)	(0.0949)	(0.0750)	(0.1016)	(0.1086)	(0.2902)	(0.2864)	(0.4614)	(0.4907)	(0.1269)	(0.1185)	(0.1714)	(0.1769)
Lev	–0.6586***	–0.7706***	–0.6597***	–0.6339***	–8.7654***	–10.8327***	–7.7502***	–7.7383***	2.0564	–4.2264*	4.8661	6.3280**	2.9408***	2.4856***	–1.6317	–2.3371**
	(0.0417)	(0.0414)	(0.0520)	(0.0551)	(0.8401)	(0.6609)	(0.7408)	(0.8028)	(2.3081)	(2.2739)	(2.9673)	(3.1728)	(0.9074)	(0.8476)	(1.0886)	(1.1282)
Fix	–0.2163***	–0.2245***	–0.2428***	–0.2503***	–1.0538***	–0.6620***	–0.7516***	–0.6134***	–8.2447***	–8.7335***	–9.6738***	–10.2908***	0.0874	0.0047	–0.0137	0.0903
	(0.0047)	(0.0047)	(0.0068)	(0.0075)	(0.0874)	(0.0695)	(0.0874)	(0.0977)	(0.2653)	(0.2634)	(0.3928)	(0.4346)	(0.1104)	(0.1038)	(0.1459)	(0.1559)
Constant	–0.2533***	0.4136***	0.4174***	0.4408***	–0.1117	–5.5891***	–1.7509***	–3.8935***	0.5527	8.8747***	–1.4954	0.0039	1.4126***	6.1647***	5.7957***	7.5605***
	(0.0161)	(0.0162)	(0.0244)	(0.0259)	(0.2972)	(0.2345)	(0.3083)	(0.3293)	(0.8982)	(0.8925)	(1.3929)	(1.4923)	(0.3783)	(0.3648)	(0.5161)	(0.5400)
Wald–Statistic	5188.69***	5056.46***	2822.46***	2502.74***	7978.12***	26,520.47***	13,070.41***	4943.03***	3215.63***	3485.67***	1371.60***	1063.20***	3125.35***	5661.35***	2327.24***	1785.00***
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 7. Interaction results using feasible generalized least squares (FGLS).

	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7
	CA	CA	CA	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA
ESG	0.0017***	0.0028***	0.0024***	0.02662***	0.0656***	0.0334***	0.1144***	0.0837***	0.1199***	0.0047*	0.0150**	–0.0000
	(0.0001)	(0.0003)	(0.0001)	(0.0017)	(0.0041)	(0.0021)	(0.0071)	(0.0194)	(0.0107)	(0.0026)	(0.0074)	(0.0038)
INO	0.0002***			0.0587***			0.0421***			0.0381***		
	(0.0000)			(0.0004)			(0.0017)			(0.0006)		
STO		0.1010*			0.3545			–2.2506			–0.2459	
		(0.0541)			(0.6086)			(2.8233)			(1.0690)	
FO			0.0006***			0.0853***			0.0300***			0.0588***
			(0.0001)			(0.0021)			(0.0111)			(0.0051)
ESG × INO	0.0006***			0.0261***			0.0344***			0.0340***		
	(0.0000)			(0.0005)			(0.0025)			(0.0010)		
ESG × STO		0.0010			0.0549***			0.0635			0.0244*	
		(0.0007)			(0.0083)			(0.0390)			(0.0148)	
ESG × FO			0.0004**			0.1111***			0.0300**			0.0707***
			(0.0002)			(0.0024)			(0.0129)			(0.0062)
Pay	0.0124***	0.0083***	0.0114***	0.1201***	0.1492***	0.3485***	1.2180***	1.2397***	1.1596***	0.3626***	0.3252***	0.1865***
	(0.0010)	(0.0016)	(0.0017)	(0.0132)	(0.0197)	(0.0201)	(0.0564)	(0.0922)	(0.1013)	(0.0224)	(0.0344)	(0.0367)
Growth	–0.0000***	–0.0001***	–0.0001***	–0.0008**	0.0001	0.0010**	–0.0025	–0.0004	0.0012	–0.0036***	–0.0029***	–0.0044***
	(0.0000)	(0.0000)	(0.0000)	(0.0004)	(0.0004)	(0.0005)	(0.0018)	(0.0020)	(0.0026)	(0.0006)	(0.0007)	(0.0009)
Fsize	–0.0249***	–0.0208***	–0.0229***	0.6995***	0.6536***	0.5680***	–0.8943***	–0.6729***	–0.6412***	–0.3254***	–0.3849***	–0.3413***
	(0.0007)	(0.0008)	(0.0009)	(0.0093)	(0.0117)	(0.0117)	(0.0387)	(0.0518)	(0.0561)	(0.0148)	(0.0191)	(0.0200)
ROE	0.0988***	0.1823***	0.1195***	0.3685***	0.5418***	–0.0898	–6.1766***	–8.5093***	–8.349***	–3.6415***	–5.5780***	–5.2933***
	(0.0052)	(0.0120)	(0.0085)	(0.0683)	(0.1010)	(0.1000)	(0.2897)	(0.4661)	(0.4984)	(0.1176)	(0.1740)	(0.1794)
Lev	–0.6520***	–0.6067***	–0.5228***	–8.1692***	–5.2743***	–5.7501***	–0.6278	10.0667***	11.9969***	0.8556	–1.8827*	–2.4108**
	(0.0414)	(0.0509)	(0.0546)	(0.5987)	(0.7388)	(0.7363)	(2.2832)	(2.9937)	(3.1978)	(0.8320)	(1.1028)	(1.1362)
Fix	–0.2236***	–0.2398***	–0.2375***	–0.6604***	–0.6053***	–0.5066***	–0.8177***	–9.4348***	–9.7774***	0.2409**	–0.0091	0.1007
	(0.0047)	(0.0070)	(0.0074)	(0.0625)	(0.0865)	(0.0889)	(0.2631)	(0.4046)	(0.4357)	(0.1015)	(0.1472)	(0.1561)
Constant	0.4179***	0.3333***	0.3661***	–2.1381***	–4.3401***	–5.1186***	1.3714	–2.2945	–3.0335**	3.2122***	6.5463***	7.4743***
	(0.0175)	(0.0350)	(0.0259)	(0.2314)	(0.3831)	(0.3047)	(0.9673)	(1.7687)	(1.5170)	(0.3763)	(0.6696)	(0.5480)
Wald–Statistic	5569.77***	3077.52***	2700.19***	33,947.20***	13,904.24***	8353.41***	3925.22***	1509.49***	1197.93***	7093.19***	2328.03***	1931.93***
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 8. Baseline regression results using two-stage least squares (2SLS).

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	CA	CA	CA	CA	ln_RD	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA	SD_ROA
ESG	0.3084***				0.0097*				0.1139***				0.0274***			
	(0.0002)				(0.0053)				(0.0151)				(0.0077)			
INO		0.0003***				0.0554***				0.1598***				0.0372***		
		(0.0000)				(0.0028)				(0.0023)				(0.0043)		
STO			0.0003**				0.0488***				0.0226**				–0.0555***	
			(0.0001)				(0.0021)				(0.0109)				(0.0098)	
FO				0.0032***				0.3253***				0.1136**				0.0217**
				(0.0011)				(0.0416)				(0.0532)				(0.0102)
Pay	0.0099***	0.0122***	0.0138**	0.0040	–0.3942***	0.1327***	0.0135	0.9072***	1.3031***	1.3708***	0.9827***	0.8348**	0.7748***	0.4052***	0.3117***	0.6944***
	(0.0011)	(0.0010)	(0.0066)	(0.0049)	(0.0232)	(0.0253)	(0.0728)	(0.2456)	(0.0608)	(0.0579)	(0.2274)	(0.3519)	(0.0275)	(0.0462)	(0.1198)	(0.1856)
Growth	–0.0000	–0.0000***	–0.0001	–0.0001	–0.0117***	0.0001	0.0043*	0.0002	–0.0082**	–0.0056***	0.0181**	0.0140	–0.0022***	–0.0093***	–0.0001	–0.0077
	(0.0000)	(0.0000)	(0.0002)	(0.0001)	(0.0010)	(0.0010)	(0.0024)	(0.0062)	(0.0032)	(0.0019)	(0.0073)	(0.0093)	(0.0008)	(0.0013)	(0.0027)	(0.0054)
Fsize	–0.0160***	–0.0163***	–0.0153***	–0.0166***	0.9368***	0.9846***	0.9124***	1.7577***	–1.2089***	–1.1624***	–0.4150***	–0.5460**	–0.4004***	–0.5123***	–0.1062	–0.7264***
	(0.0009)	(0.0006)	(0.0038)	(0.0036)	(0.0159)	(0.0138)	(0.0433)	(0.1797)	(0.0468)	(0.0374)	(0.1566)	(0.2277)	(0.0208)	(0.0212)	(0.1046)	(0.1257)
ROE	0.0895***	0.1133***	0.0506	0.1081***	1.4174***	1.0044***	0.9183**	2.9241**	–10.3584***	5.3430***	–8.3396***	–6.5416***	–4.0572***	–3.9716***	–6.8491***	–1.8984**
	(0.0065)	(0.0054)	(0.0379)	(0.0249)	(0.1179)	(0.1012)	(0.3942)	(1.3297)	(0.5043)	(0.2931)	(1.2809)	(1.6438)	(0.1558)	(0.1597)	(0.5986)	(0.8759)
Lev	–0.9672***	–0.7084***	–2.0353***	–2.7904***	–8.1813***	–10.4932***	–10.6371**	–67.6274***	–50.4295***	–47.6770***	–86.9109***	–146.5681***	–0.2388	0.9703	13.0695**	–2.7963
	(0.0739)	(0.0443)	(0.4104)	(0.3084)	(1.1455)	(1.0487)	(4.4672)	(21.5432)	(3.7092)	(2.8574)	(13.7302)	(30.1172)	(1.3920)	(1.6162)	(5.6102)	(15.1705)
Fix	–0.2016***	–0.2146***	–0.2897***	–0.3599***	–0.9791***	–0.5164***	–2.4669***	1.5327	–7.2603***	–7.0090***	–6.0954***	–6.6122***	–0.1303	–0.1135	–1.0368**	–1.7544**
	(0.0058)	(0.0050)	(0.0291)	(0.0198)	(0.1074)	(0.0896)	(0.3210)	(0.0676)	(0.3160)	(0.2767)	(0.9794)	(1.5474)	(0.1348)	(0.1334)	(0.4077)	(0.8599)
Constant	0.2183***	0.3713***	0.3841***	0.5646***	1.8676***	–5.9168***	–1.7669*	–34.4441***	6.8400***	12.5742***	1.1347	7.2117	0.6325	6.1560***	–2.1007	7.8968***
	(0.0205)	(0.0175)	(0.0928)	(0.1013)	(0.3873)	(0.4848)	(1.0446)	(4.4502)	(1.0595)	(0.9295)	(3.4743)	(5.2702)	(0.4825)	(0.8732)	(1.8237)	(2.5443)
Wald–Statistic	2752.72***	3918.74***	308.22***	598.76***	5792.13***	7403.17***	2601.48***	148.36***	2646.17***	3160.75***	240.70***	96.68***	1979.77***	2043.07***	407.98***	62.71***
Sargan Statistic	2.9323	1.6712	1.0544	1.444	1.4354	2.9310	3.8642	2.1279	1.39	0.5688	1.2349	1.2795	0.0800	0.4055	1.2382	2.1658
p-value	0.2308	0.1961	0.5902	0.2295	0.2309	0.2310	0.1448	0.3451	0.4991	0.4507	0.2664	0.5274	0.7773	0.5242	0.2658	0.5387
Basmann Statistic	2.9308	1.6706	1.0440	1.4403	1.4347	2.9294	3.8311	2.1131	1.38917	0.5685	1.22439	1.2621	0.0799	0.4052	1.2315	2.11048
p-value	0.2310	0.1962	0.5933	0.2301	0.2310	0.2311	0.1473	0.3476	0.4993	0.4508	0.2685	0.5320	0.7773	0.5244	0.2671	0.5498
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 9. Interaction results using two-stage least squares (2SLS).

	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7
	CA	CA	CA	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA
ESG	0.0048***	0.0047***	0.0036***	0.0503***	0.1763***	0.0281***	0.1216***	0.4521***	0.2470***	0.0632***	0.0029***	0.0843***
	(0.0007)	(0.0011)	(0.0003)	(0.0067)	(0.0323)	(0.0046)	(0.0154)	(0.0572)	(0.0198)	(0.0179)	(0.0006)	(0.0301)
INO	0.0001***			0.0596***			0.0074***			0.0388***		
	(0.0000)			(0.0005)			(0.0020)			(0.0008)		
STO		0.0034**			0.1459***			0.4291***			–0.3983***	
		(0.0014)			(0.0428)			(0.0753)			(0.0906)	
FO			0.0009***			0.0971***			0.0356**			0.0565***
			(0.0002)			(0.0034)			(0.0145)			(0.0065)
ESG × INO	0.0006***			0.0199***			0.0324***			0.0262***		
	(0.0000)			(0.0008)			(0.0028)			(0.0016)		
ESG × STO		0.0046**			0.2506***			0.5796***			0.0057***	
		(0.0019)			(0.0579)			(0.1019)			(0.0012)	
ESG × FO			0.0009***			0.1207***			0.0533***			0.0610***
			(0.0003)			(0.0042)			(0.0180)			(0.0081)
Pay	0.0108***	0.0084***	0.0104***	0.1475***	–0.0493*	0.2091***	1.1630***	1.1401***	1.1392***	0.3986***	0.0049***	0.2379***
	(0.0013)	(0.0020)	(0.0022)	(0.0173)	(0.0292)	(0.0269)	(0.0623)	(0.1035)	(0.1139)	(0.0310)	(0.0005)	(0.0579)
Growth	–0.0000	–0.0000	–0.0000	0.0018**	0.0013	0.0008	–0.0111***	–0.0043	–0.0036	–0.0082***	–0.0065***	–0.0074***
	(0.0000)	(0.0000)	(0.0000)	(0.0008)	(0.0008)	(0.0007)	(0.0032)	(0.0032)	(0.0033)	(0.0011)	(0.0017)	(0.0014)
Fsize	–0.0278***	–0.0180***	–0.0236***	0.7644***	0.7229***	0.6540***	–0.9921***	–1.1576***	1.2682***	–0.2069***	–0.0027***	–0.1319**
	(0.0011)	(0.0012)	(0.0013)	(0.0141)	(0.0194)	(0.0174)	(0.0491)	(0.0635)	(0.0738)	(0.0272)	(0.0004)	(0.0574)
ROE	0.0813***	0.0944***	0.1057***	0.2139**	0.5664***	0.0046	–5.5213***	–10.0684***	–10.3242***	–3.3463***	–0.0814***	–5.5272***
	(0.0076)	(0.0111)	(0.0115)	(0.0929)	(0.1701)	(0.1414)	(0.3355)	(0.5721)	(0.5965)	(0.1752)	(0.0049)	(0.3266)
Lev	–0.7245***	–0.7648***	–0.4845***	–7.4823***	–1.3770	–6.8522***	–52.8508***	–58.3575***	–62.3627***	–3.0528	–0.0966***	–15.3878***
	(0.0895)	(0.1022)	(0.0882)	(1.0887)	(1.5440)	(1.4455)	(3.7672)	(5.2511)	(6.0779)	(1.9530)	(0.0313)	(3.3504)
Fix	–0.2159***	–0.2275***	–0.2368***	–0.6383***	–0.6406***	–0.6064***	–6.3744***	–6.6908***	–6.8434***	–0.0480	–0.0001	–0.2468
	(0.0062)	(0.0088)	(0.0100)	(0.0817)	(0.1232)	(0.1213)	(0.3005)	(0.4558)	(0.5111)	(0.1362)	(0.0024)	(0.2489)
Constant	0.2811***	0.1322*	0.3017***	–5.4048***	–10.8408***	–4.2822***	3.9955***	–16.6240***	1.2939	4.7803***	0.2192***	8.3214***
	(0.0367)	(0.0744)	(0.0335)	(0.3796)	(2.0136)	(0.4033)	(1.1859)	(3.8261)	(1.7036)	(0.7898)	(0.0390)	(1.0320)
Wald–Statistic	3296.37***	1594.07***	1447.57***	20,839.52***	8339.14***	4951.76***	2639.98***	1414.37***	1234.94***	4240.86***	1075.08***	1023.95***
Sargan Statistic	2.2579	0.1194	2.4734	0.0870	0.9089	2.3387	1.7182	0.0218	0.2537	0.2336	2.3088	0.0069
p-value	0.1329	0.7297	0.1158	0.7680	0.3404	0.1262	0.4235	0.8825	0.6144	0.6288	0.1286	0.9337
Basmann Statistic	2.2566	0.1192	2.4698	0.0869	0.9075	2.3350	1.7170	0.0218	0.2532	0.2334	2.3049	0.0069
p-value	0.1330	0.7299	0.1161	0.7681	0.3408	0.1265	0.4238	0.8826	0.6148	0.6290	0.1290	0.9338
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 10. Baseline regression results using two-step generalized method of moments (GMM).

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	CA	CA	CA	CA	ln_RD	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA	SD_ROA
ESG	0.0024***				0.0457***				0.1047***				0.0278***			
	(0.0002)				(0.0084)				(0.0166)				(0.0057)			
INO		0.0003***				0.0517***				0.0125***				0.0412***		
		(0.0000)				(0.0031)				(0.0024)				(0.0032)		
STO			0.0002**				0.0492***				0.0675***				–0.0223***	
			(0.0001)				(0.0022)				(0.0166)				(0.0021)	
FO				0.0059***				0.0161***				21.3679***				0.2521***
				(0.0014)				(0.0044)				(4.5934)				(0.0354)
Pay	0.0092***	0.0122***	0.01972***	–0.0155	–0.2683***	0.1133***	–0.0057	–0.0545	1.2593***	1.4848***	1.6528***	2.5981***	0.7748***	0.3566***	0.4872***	–0.4288
	(0.0012)	(0.0011)	(0.0066)	(0.0107)	(0.0228)	(0.0261)	(0.0752)	(0.0982)	(0.0682)	(0.0675)	(0.2453)	(0.2583)	(0.0275)	(0.0382)	(0.0916)	(0.3307)
Growth	–0.0086	–0.0001***	–0.0004**	0.0003	–0.0092***	–0.0003	0.0016	–0.0011	–0.0095**	–0.0041*	–0.0103	–0.0052	–0.0022*	–0.0079***	0.0015	–0.0008
	(0.0076)	(0.0000)	(0.0002)	(0.0004)	(0.0013)	(0.0013)	(0.0031)	(0.0014)	(0.0041)	(0.0024)	(0.0087)	(0.0091)	(0.0012)	(0.0021)	(0.0032)	(0.0086)
Fsize	–0.0160***	–0.0163***	–0.0171***	–0.0165**	0.8281***	0.9868***	0.9307***	1.1548***	–1.1634***	–1.1246***	–0.2168	–0.1141	–0.4001***	–0.5044***	–0.2924***	–0.8852***
	(0.0010)	(0.0008)	(0.0033)	(0.0073)	(0.0197)	(0.0157)	(0.0439)	(0.0651)	(0.0513)	(0.0515)	(0.2138)	(0.2309)	(0.0219)	(0.0224)	(0.0470)	(0.1865)
ROE	0.1520***	0.1138***	0.0972**	0.1017	1.1507***	0.9139***	1.9297***	–0.2210	–10.1308***	–9.3326***	–13.2752***	–14.7812***	–4.0568***	–4.1434***	–6.1250***	–2.4931*
	(0.0102)	(0.0066)	(0.0398)	(0.0728)	(0.1305)	(0.1030)	(0.4458)	(0.4882)	(0.6654)	(0.5980)	(1.6670)	(1.8887)	(0.2688)	(0.2824)	(0.7886)	(1.4920)
Lev	–1.0135***	–0.7020***	–1.4868***	–4.2781***	–6.4150***	–10.3885***	–7.5426*	–27.5926***	–46.8716***	–46.6005***	–99.3912***	–194.9519***	–0.2548	2.6928	–10.4426*	–22.0476
	(0.1128)	(0.1357)	(0.3476)	(1.5712)	(1.4449)	(1.3267)	(4.5817)	(8.9104)	(6.1837)	(10.6326)	(20.6561)	(29.9698)	(1.9979)	(2.7104)	(5.7102)	(19.1060)
Fix	–0.2009***	–0.2144***	–0.2788***	–0.4225***	–0.7385***	–0.5258***	–2.2912***	–0.2352	–6.6523***	–7.1120***	–7.9727***	–6.9061***	–0.1316	–0.1546	–0.6599**	–5.9889***
	(0.0051)	(0.0045)	(0.0226)	(0.0479)	(0.1192)	(0.1005)	(0.5276)	(0.4136)	(0.3158)	(0.2717)	(0.9546)	(1.3897)	(0.1267)	(0.1253)	(0.3119)	(1.6587)
Constant	0.2337***	0.3719***	0.3254***	0.8632***	–0.2887	–5.7214***	–1.9908*	–8.6263***	7.0000***	10.2785***	–14.0535***	–24.6154***	0.6586	6.6555***	0.4321	27.6589***
	(0.0218)	(0.0200)	(0.0928)	(0.1571)	(0.2887)	(0.5221)	(1.1261)	(1.3435)	(1.1206)	(1.1000)	(4.0701)	(5.0707)	(0.4714)	(0.7540)	(1.3471)	(4.8173)
Wald–Statistic	2624.34***	3630.70***	281.21***	166.93***	3865.52***	6026.49***	2585.85***	464.25***	1559.13***	2463.44***	397.91***	296.87***	1211.45***	1412.31***	630.80***	131.74***
Hansen's J statistic	2.8028	1.5783	3.1312	3.5960	8.9152	1.8839	4.4491	2.4720	4.6253	0.5578	1.3461	0.7281	0.0824	0.4696	1.0608	0.4051
p-value	0.2462	0.2090	0.3718	0.1656	0.0028	0.1699	0.2169	0.2905	0.2014	0.4551	0.2459	0.3935	0.7740	0.4932	0.3030	0.9392
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 11. Interaction regression results using two-step generalized method of moments (GMM).

	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7	Model 5	Model 6	Model 7
	CA	CA	CA	ln_RD	ln_RD	ln_RD	Inn_In	Inn_In	Inn_In	SD_ROA	SD_ROA	SD_ROA
ESG	0.0049***	0.0058***	0.0037***	0.0170***	0.1677***	0.0211*	0.1419***	0.5114***	0.2463***	0.0014***	0.4473***	0.0925***
	(0.0007)	(0.0012)	(0.0004)	(0.0040)	(0.0360)	(0.0121)	(0.0253)	(0.0564)	(0.0185)	(0.0002)	(0.1145)	(0.0291)
INO	0.0001**			0.0591***			0.0107***			0.2162***		
	(0.0000)			(0.0005)			(0.0019)			(0.0322)		
STO		0.0046***			0.1381***			47.7479***			–0.5812***	
		(0.0016)			(0.0488)			(7.3290)			(0.1503)	
FO			0.0005**			0.0847***			0.0354***			0.0547***
			(0.0002)			(0.0037)			(0.0105)			(0.0043)
ESG × INO	0.0006***			0.0245***			0.0299***			0.0028***		
	(0.0000)			(0.0008)			(0.0030)			(0.0004)		
ESG × STO		0.0062***			0.2423***			0.6439***			0.8103***	
		(0.0021)			(0.0660)			(0.0991)			(0.2034)	
ESG × FO			0.0008**			0.1060***			0.0533***			0.0593***
			(0.0004)			(0.0046)			(0.0120)			(0.0049)
Pay	0.0107***	0.0069***	0.0103***	0.1326***	–0.0779**	0.2295***	1.2241***	1.1547***	1.1412***	0.0080***	0.4733***	0.2605***
	(0.0014)	(0.0020)	(0.0022)	(0.0171)	(0.0334)	(0.0321)	(0.0684)	(0.1064)	(0.1138)	(0.0002)	(0.0654)	(0.0554)
Growth	–0.0000	–0.0000	–0.0000	–0.0010	0.0009	0.0005	–0.0123***	–0.0023	–0.0036	–0.0016	–0.0056***	–0.0060***
	(0.0000)	(0.0000)	(0.0000)	(0.0009)	(0.0011)	(0.0009)	(0.0040)	(0.0039)	(0.0041)	(0.0012)	(0.0021)	(0.0021)
Fsize	–0.0279***	–0.0197***	–0.0234***	0.8117***	0.7550***	0.6844***	–1.0697***	–1.2421***	–1.2666***	–0.0033***	–0.2466***	–0.1183*
	(0.0012)	(0.0013)	(0.0016)	(0.013)	(0.0215)	(0.0262)	(0.0534)	(0.0790)	(0.0726)	(0.0002)	(0.0465)	(0.0631)
ROE	0.0811***	0.1038***	0.1035***	0.3746***	0.8488***	0.0970	–5.914***	–9.5491***	–10.3289***	–0.0622***	–5.5589***	–5.7614***
	(0.0076)	(0.0139)	(0.0147)	(0.0916)	(0.1961)	(0.1727)	(0.4315)	(0.8331)	(0.7426)	(0.0034)	(0.6089)	(0.5614)
Lev	–0.7180***	–0.5067***	–0.4895**	–7.8526***	–0.1312	–6.2779***	–50.7168***	–27.9154**	–62.6227***	0.0132	–14.8190**	–16.57**
	(0.1080)	(0.1837)	(0.2113)	(1.1226)	(1.6354)	(1.8127)	(6.0677)	(12.2921)	(7.6133)	(0.0161)	(5.7666)	(6.5556)
Fix	–0.2157***	–0.2343***	–0.2376***	–0.7355***	–0.5315***	–0.6443***	–6.5133***	–7.1698***	–6.8334***	–0.0001	–0.2838	–0.3722
	(0.0056)	(0.0079)	(0.0088)	(0.0910)	(0.1472)	(0.1511)	(0.2935)	(0.4829)	(0.5419)	(0.0014)	(0.2353)	(0.2456)
Constant	0.2777***	0.1057	0.2981***	–3.9241***	–10.4851***	–4.7539***	3.2539**	–19.5772***	1.2784	0.0752***	33.1307***	8.3512***
	(0.0364)	(0.0837)	(0.0359)	(0.3249)	(2.2876)	(0.5668)	(1.3738)	(3.8073)	(1.6862)	(0.0169)	(7.3858)	(1.1175)
Wald–Statistic	2856.45***	1507.10***	1360.95***	18,941.05***	6281.83***	4282.46***	2282.86***	982.81***	925.13***	1613.38***	754.82***	1009.71***
Hansen's J Statistic	2.4160	0.0010	2.4680	2.3515	0.4590	2.1607	2.3497	1.50664	0.2532	1.1303	0.1542	0.2500
p-value	0.1201	0.9744	0.1162	0.1252	0.4980	0.3395	0.1253	0.2197	0.6148	0.2877	0.6945	0.6170
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

Table 12. ESG performance in environmentally sensitive vs. environmentally non-sensitive firms using the fixed effects model (FE).

	Panel A: Environmentally sensitive firms				Panel B: Environmentally non-sensitive firms			
	Model 1				Model 2			
	CA	ln_RD	Inn_In	SD_ROA	CA	ln_RD	Inn_In	SD_ROA
ESG	0.0006***	0.0083***	0.0145***	0.0250***	0.0005***	0.0068***	0.0094*	0.0192***
	(0.0001)	(0.0029)	(0.0053)	(0.0038)	(0.0001)	(0.0024)	(0.0049)	(0.0035)
Pay	–0.0062***	–0.6353***	0.3763***	0.1820***	–0.0045***	–0.7023***	0.3590***	0.5289***
	(0.0014)	(0.0311)	(0.0581)	(0.0429)	(0.0012)	(0.0245)	(0.0501)	(0.0363)
Growth	–0.0001***	–0.0034***	–0.0220***	–0.0044***	–0.0000***	–0.0033***	–0.1260***	–0.0005
	(0.0000)	(0.0007)	(0.0012)	(0.0008)	(0.0000)	(0.0005)	(0.0010)	(0.0006)
Fsize	–0.0124***	–0.3333***	0.1610*	0.9478***	–0.0146***	–0.0080	–0.0615	0.3992***
	(0.0020)	(0.0449)	(0.0846)	(0.0687)	(0.0016)	(0.0310)	(0.0638)	(0.0484)
ROE	0.0531***	1.9650***	–3.3295***	–3.8554***	0.0557***	1.3693***	–3.5943***	–3.4857***
	(0.0062)	(0.1376)	(0.2524)	(0.2033)	(0.0049)	(0.0932)	(0.1894)	(0.1531)
Lev	–0.2621***	0.6284	–1.0190	–5.3564*	–0.2477***	–4.7222***	–4.9669**	8.3478***
	(0.0752)	(1.7805)	(3.0216)	(2.1522)	(0.0545)	(1.0678)	(2.1007)	(1.9382)
Fix	–0.2725***	–2.7000***	–0.5903	–0.7608**	–0.2327***	–2.3820***	0.5052	0.4140
	(0.0113)	(0.2428)	(0.4554)	(0.3481)	(0.0108)	(0.2047)	(0.4177)	(0.3196)
Constant	0.5412***	34.8061***	–3.6814**	–23.3815***	0.5615***	28.7969***	1.7775	–16.8362***
	(0.0436)	(0.9365)	(1.7702)	(1.3981)	(0.0344)	(0.6512)	(1.3360)	(0.9984)
F–Statistic	131.06***	157.94***	94.12***	114.85***	126.43***	220.60***	94.73***	170.55***
Within R^2	0.0768	0.0938	0.0566	0.0985	0.0521	0.0894	0.0399	0.1031
Industry & Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * indicate statistical significance at 1 %, 5%, and 10% levels, respectively. Standard errors are in parentheses.

ing for reverse causality. However, its reliability depends on the strength and validity of the instruments. To further strengthen the robustness of the results and account for unobserved and firm-specific heterogeneity, this study used the two-step GMM estimation, which is suitable for panel data with potentially endogenous regressors.

To assess the appropriateness, relevance, and validity of our instruments, we conducted several post-estimation tests for each model, including tests for endogeneity, weak instruments, and instrument validity. For the 2SLS estimations, the Sargan and Basmann statistic indicate that the overidentifying restrictions are satisfied, while the majority of significant Durbin and Wu-Hausman statistic confirm the presence of endogeneity. Moreover, all F–statistic from the first-stage regressions were significant and exceeded 10, indicating that the instruments are strong. However, for brevity, we only reported Sargan and Basmann statisitcs and did not report other statistics in Tables 8, 9, and 10, for two-step GMM estimations, the majority of insignificant Hansen's J statistic suggest that the instruments are valid. Most results corroborate the main findings presented in Tables 4,5, further strengthening the credibility of our novel contributions to literature. Hence, the consistency of results across multiple econometric approaches suggests that the relationship among ESG performance, ownership structure, and firm risk-taking is not driven by endogeneity, thereby strengthening the credibility of this study's empirical contributions to the existing body of knowledge.

5.2 Environmentally Sensitive and Environmentally Non-Sensitive Firms

To further strengthen our contribution, we examined whether ESG performance affects a firm risk-taking differently across environmentally sensitive and environmentally non-sensitive industries. It may be argued that ESG performance contributes to firm risk-taking only if the firm belongs to environmentally sensitive sectors. To test this, we divided the sample into two sub-samples, i.e., Panel A, which includes firms operating in environmentally sensitive industries such as metals, mining, chemicals, oil, paper, and utilities, consistent with Radhouane et al. (2020). Panel B includes firms that operate in environmentally non-sensitive industries. The results are reported in Table 12. The results suggest that ESG performance significantly and positively affects firm risk-taking across both sub-samples, regardless of whether firms operate in environmentally sensitive or non-sensitive industries. The positive relationship further strengthens the validity of our main results.

6. Conclusion

This study investigated the effect of ESG performance on firm risk-taking and how ownership structure moderates this relationship. We used a panel dataset of Chinese non-financial firms and employed fixed-effects (FE) panel regression and Feasible Generalized Least Squares (FGLS) for empirical estimation. The results suggest that ESG performance positively influences firm risk-taking, and ownership structure positively moderates the re-

lationship between ESG performance and firm risk-taking. We argue that firms derive greater benefits from ESG performance in the presence of institutional, state, and foreign ownership structures, as these ownership structures strengthen governance mechanisms that influence a firm risk-taking decisions. In addition, we also investigated whether ESG performance affects differently in environmentally sensitive and environmentally non-sensitive firms by dividing the sample into two sub-samples. The results suggest that ESG performance significantly and positively affects firm risk taking in both environmentally sensitive and environmentally non-sensitive industries. The study also uses the 2SLS and two-step GMM approaches to address potential endogeneity issues. Our results are robust across multiple statistical techniques and alternative measures of key variables, thereby strengthening our contribution to the literature.

6.1 Theoretical Implications

The findings of this study have several theoretical implications. First, this study contributes to prior research that reports mixed results on the relationship between ESG performance and firm risk-taking (Du and Nik Azman, 2024; He et al., 2023). Second, this study extends the literature by investigating the moderating role of ownership structure on the relationship between ESG performance and firm risk-taking. These findings highlight ownership structure as a governance mechanism that shapes how ESG performance influences firm risk-taking. Third, focusing on Chinese listed firms, an emerging market with concentrated ownership and evolving ESG regulation, this study enriches theory largely developed in mature markets and provides a more nuanced understanding of ESG-risk dynamics. Finally, the findings indicate that ESG performance is relevant for firms in both environmentally sensitive and non-sensitive firms, suggesting that ESG's theoretical importance extends beyond high-pollution sectors. Overall, the results contribute to agency, stakeholder, and risk management theories (Clifford and Smith, 1995; Freeman, 1984; Jensen and Meckling, 1979).

6.2 Policy Implications

The findings offer significant policy implications for regulators and policymakers, especially as ESG disclosure requirements continue to expand in China. Recent policy developments, including the 2024 sustainability reporting requirements introduced by China's three stock exchanges and the release of the Basic Standards (Trial), show that regulatory attention to corporate sustainability reporting is increasing. In this context, as ESG performance is positively associated with firm risk-taking, regulatory bodies need to monitor whether ESG-driven risk-taking is used productively to invest in innovation, technology, and transformation. Moreover, because ownership plays a crucial role in moderating the effect of ESG performance on firm risk-taking, policymakers should adopt a more differentiated approach to ESG oversight by paying closer attention to ownership heterogeneity and governance quality. Firms whose ownership and governance arrangements may promote excessive firm risk-taking behavior need to be subjected to stringent monitoring, disclosure analysis, and accountability measures. On the other hand, firms that exhibit strong ESG performance alongside sound governance should be encouraged with policy benefits, including green finance and innovation initiatives. Such policies will allow firms to channel their firm risk-taking behavior toward positive outcomes and make the process sustainable in the long run. Finally, these results may also offer policymakers in other emerging and transitional economies, such as Eastern Europe, useful insights, as ESG management is rapidly gaining ground amid low levels of corporate governance, concentrated ownership, and risk oversight. In such contexts, ESG policy should also balance accountability with strategic flexibility so that sustainability efforts support both risk control and long-term value creation.

6.3 Managerial Implications

For Managers, the results suggest that ESG engagement can be viewed as a strategic tool rather than a compliance tool. Managers can recognize that the risk consequences of ESG initiatives may depend on the firm's ownership structure and investor preferences. Aligning ESG strategies with investor's preferences and communicating ESG initiatives transparently will help ensure the ESG investments are perceived as value-addition rather than risk-averse, particularly in firms with diverse ownership structures.

6.4 Limitations and Future Research Recommendations

While this study provides new insights into the relationships among ESG performance, firm risk-taking, and ownership structure, it also has certain limitations. The focus on Chinese-listed non-financial firms may limit the generalizability of the results. Future research could broaden the scope by examining other institutional settings and incorporating additional firm and market-level characteristics, including board structure and firm life cycle.

Availability of Data and Materials

The data used in the study is confidential. However, authors may consider sharing it upon a reasonable request.

Author Contributions

ZL: Study design, research implementation, data collection and analysis, and preparation of the original manuscript draft. KL: Research supervision, methodological guidance, and critical review. A: Investigation, validation, and critical revision of the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflicts of interest.

References

Abdullah NAIN, Haron R. ESG Practices and Firm Risk: Evidence from Malaysia. In Mansour N, Vadell LM (eds.) Islamic Sustainable Finance, Law and Innovation: Opportunities and Challenges (pp. 501–510). Springer Nature Switzerland: Cham. 2023.

Abdullah, Zhu N, Hashmi MA, Shah MH. CEO power, board features and ESG performance: An extensive novel moderation analysis. Corporate Social Responsibility and Environmental Management. 2024; 31: 5627–5655. https://doi.org/10.1002/csr.2886

Abidi I, Nsaibi M, Hussainey K. Does Ownership Structure Moderate the Relationship between Systemic Risk and Corporate Governance? Evidence from Gulf Cooperation Council Countries. Journal of Risk and Financial Management. 2022; 15: 216. https://doi.org/10.3390/jrfm15050216

Acar E, Tunca Çalıyurt K, Zengin-Karaibrahimoglu Y. Does ownership type affect environmental disclosure? International Journal of Climate Change Strategies and Management. 2021; 13: 120–141. https://doi.org/10.1108/ijccsm-02-2020-0016

Adardour Z, Ed-Dafali S, Derj A, Sbai H, Bami A. Environmental, social and governance (ESG) performance and firm risk: a systematic literature review, practical insights and future directions. Journal of Financial Reporting and Accounting. 2026; 1–27. https://doi.org/10.1108/jfra-05-2025-0343

Adardour Z, Ed-Dafali S, Sbai H, Hussainey K. ESG Performance, Family Ownership, and Corporate Risk-Taking: The Moderating Role of the CSR Committee. International Journal of Finance & Economics. 2025; 31: 1979–1994. https://doi.org/10.1002/ijfe.70026

Aiken LS, West SG, Reno RR. Multiple regression: Testing and interpreting interactions. Sage: Thousand Oaks. 1991.

Alam S, Das SK, Dipa UR, Hossain SZ. Predicting financial distress through ownership pattern: dynamics of financial resilience of Bangladesh. Future Business Journal. 2024; 10: 91. https://doi.org/10.1186/s43093-024-00379-5

Ali S, Zhang J, Naseem MA, Ahmad F. Moderating Role Of Ownership In Relationship Between CSRD And Firm Performance. The Journal of Developing Areas. 2019; 53: 213–228. https://doi.org/10.1353/jda.2019.0048

Alshirah M, Alshira'h A. The impact of corporate ownership structure on corporate risk disclosure: evidence from an emerging economy. Competitiveness Review: an International Business Journal. 2024; 34: 370–395. https://doi.org/10.1108/cr-01-2023-0007

Alsultan A, Hussainey K. The Moderating Effect of Ownership Structure on the Relationship between Related Party Transactions and Earnings Quality: Evidence from Saudi Arabia. International Journal of Financial Studies. 2024; 12: 58. https://doi.org/10.3390/ijfs12030058

Anton CE, Baba CM, Bucşoiu OA. Perspectives on Integrating Risk Management and Sustainability for Financial Performance: A Systematic Literature Review. Sustainability. 2025; 17: 3456. https://doi.org/10.3390/su17083456

Atan R, Alam MM, Said J, Zamri M. The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. Management of Environmental Quality: an International Journal. 2018; 29: 182–194. https://doi.org/10.1108/meq-03-2017-0033

Aziz NHA, Alshdaifat SM. ESG Reporting: Impacts, Benefits and Challenges. In Alshurafat H, Hamdan A, Sands J (eds.) Sustainable Horizons for Business, Education, and Technology: Interdisciplinary Insights (pp. 69–76). Springer: Singapore. 2024.

Azzam A, Alhababsah S. Does state ownership affect R&D investments? Evidence from China. Cogent Business & Management. 2022; 9: 2095888. https://doi.org/10.1080/23311975.2022.2095888

Bai X, Han J, Ma Y, Zhang W. ESG performance, institutional investors' preference and financing constraints: Empirical evidence from China. Borsa Istanbul Review. 2022; 22: S157–S168. https://doi.org/10.1016/j.bir.2022.11.013

Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology. 1986; 51: 1173–1182. https://doi.org/10.1037//0022-3514.51.6.1173

Bilyay-Erdogan S, Öztürkkal B. The Role of Environmental, Social, Governance (ESG) Practices and Ownership on Firm Performance in Emerging Markets. Emerging Markets Finance and Trade. 2023; 59: 3776–3797. https://doi.org/10.1080/1540496x.2023.2223930

Bissoondoyal-Bheenick E, Brooks R, Do HX. ESG and firm performance: The role of size and media channels. Economic Modelling. 2023; 121: 106203. https://doi.org/10.1016/j.econmod.2023.106203

Boubakri N, Cosset JC, Saffar W. The role of state and foreign owners in corporate risk-taking: Evidence from privatization. Journal of Financial Economics. 2013; 108: 641–658. https://doi.org/10.1016/j.jfineco.2012.12.007

Bouslah K, Kryzanowski L, M'Zali B. Social Performance and Firm Risk: Impact of the Financial Crisis. Journal of Business Ethics: JBE. 2018; 149: 643–669. https://doi.org/10.1007/s10551-016-3017-x

Bushee BJ. The influence of institutional investors on myopic R&D investment behavior. Accounting Review. 1998; 73: 305–333. https://doi.org/10.2308/TAR-902584

Cai W, Deng L, Liu Y. ESG performance and corporate financial performance under dual-carbon targets: The moderating effect of external pressure. Financ. Theory Pract. 2023; 6: 69–81.

Chen KH, Zhang Y, Elston JA, Chen PH, Hsu KH. Environmental, social, and governance (ESG) initiative scores and firm performance: the importance and role of firm size. Small Business Economics. 2026; 66: 71–95. https://doi.org/10.1007/s11187-025-01096-1

Chen S, Fan M. ESG ratings and corporate success: analyzing the environmental governance impact on Chinese companies' performance. Frontiers in Energy Research. 2024; 12: 1371616. https://doi.org/10.3389/fenrg.2024.1371616

Chen S, Thi Kim D, Hsu F. ESG and firm's risk-taking: International study. In Proceedings of 5th International Conference on Research in Management and Economics. 2021.

Cheng Y, He C, Tang C. The impact of ESG performance on corporate debt costs: A signaling perspective. Finance Research Letters. 2025; 76: 107020. https://doi.org/10.1016/j.frl.2025.107020

Clifford W, Smith J. Corporate risk management: theory and

practice. The Journal of Derivatives. 1995; 2: 21–30. https://doi.org/10.3905/jod.1995.407920

Dai L, Wang J. The impact of ESG rating disagreement on corporate risk-taking: evidence from China. Digital Economy and Sustainable Development. 2024; 2: 18. https://doi.org/10.1007/s44265-024-00041-6

Dakhli A. The impact of ownership structure on corporate social responsibility: the moderating role of financial performance. Society and Business Review. 2021; 16: 562–591. https://doi.org/10.1108/sbr-01-2021-0013

Dawson JF. Moderation in Management Research: What, Why, When, and How. Journal of Business and Psychology. 2014; 29: 1–19. https://doi.org/10.1007/s10869-013-9308-7

de Souza Barbosa A, da Silva MCBC, da Silva LB, Morioka SN, de Souza VF. Integration of Environmental, Social, and Governance (ESG) criteria: their impacts on corporate sustainability performance. Humanities and Social Sciences Communications. 2023; 10: 410. https://doi.org/10.1057/s41599-023-01919-0

Deng X, Li W, Ren X. More sustainable, more productive: Evidence from ESG ratings and total factor productivity among listed Chinese firms. Finance Research Letters. 2023; 51: 103439. https://doi.org/10.1016/j.frl.2022.103439

Ding H, Wang Z, Xu H, Lin Z. A Study on the Impact of Board Characteristics on the Environmental, Social, and Governance (ESG) Responsibilities of Listed Companies—Evidence from Chinese Listings. Sustainability. 2024; 16: 10490. https://doi.org/10.3390/su162310490

Du L, Nik Azman NH. The impact of ESG performance on corporate risk-taking: empirical evidence from China. Journal of Sustainable Finance & Investment. 2024; 14: 745–765. https://doi.org/10.1080/20430795.2024.2366179

Du L, Nik Azman NH. The impact of ESG performance on corporate risk-taking: empirical evidence from China. Journal of Sustainable Finance & Investment. 2024; 14: 745–765. https://doi.org/10.1080/20430795.2024.2366179

Dyck A, Lins KV, Roth L, Wagner HF. Do institutional investors drive corporate social responsibility? International evidence. Journal of Financial Economics. 2019; 131: 693–714. https://doi.org/10.1016/j.jfineco.2018.08.013

Eccles RG, Ioannou I, Serafeim G. The Impact of Corporate Sustainability on Organizational Processes and Performance. Management Science. 2014; 60: 2835–2857. https://doi.org/10.1287/mnsc.2014.1984

Edacherian S, Panicker VS, Chizema A. R&D investments in emerging market firms: the role of institutional investors and board interlocks. R&D Management. 2024; 54: 993–1015. https://doi.org/10.1111/radm.12678

Eliwa Y, Aboud A, Saleh A. ESG practices and the cost of debt: Evidence from EU countries. Critical Perspectives on Accounting. 2021; 79: 102097. https://doi.org/10.1016/j.cpa.2019.102097

Faccio M, Marchica MT, Mura R. Large Shareholder Diversification and Corporate Risk-Taking. Review of Financial Studies. 2011; 24: 3601–3641. https://doi.org/10.1093/rfs/hhr065

Fama EF, Jensen MC. Agency problems and residual claims. The Journal of Law and Economics. 1983; 26: 327–349. https://doi.org/10.1086/467038

Fan JPH, Wong TJ, Zhang T. Institutions and Organizational Structure: The Case of State-Owned Corporate Pyramids. Journal of Law, Economics, and Organization. 2013; 29: 1217–1252. https://doi.org/10.1093/jleo/ews028

Freeman RE. Corporate views of the public interest. Academy of Management Review. 1984; 9: 366–368. https://doi.org/10.5465/amr.1984.4277733

Freeman RE. Strategic management: A stakeholder approach. Cambridge University Press: Cambridge. 2010.

Fu J. ESG, Stock Returns and Stock Volatility: Evidence from Chinese Listed Companies. SHS Web of Conferences. 2024; 181: 02002. https://doi.org/10.1051/shsconf/202418102002

Fuadah LL, Mukhtaruddin M, Andriana I, Arisman A. The Ownership Structure, and the Environmental, Social, and Governance (ESG) Disclosure, Firm Value and Firm Performance: The Audit Committee as Moderating Variable. Economies. 2022; 10: 314. https://doi.org/10.3390/economies10120314

Garcia AS, Mendes-Da-Silva W, Orsato RJ. Sensitive industries produce better ESG performance: Evidence from emerging markets. Journal of Cleaner Production. 2017; 150: 135–147. https://doi.org/10.1016/j.jclepro.2017.02.180

Gopalan R, Gormley TA, Kalda A. It's not so bad: Director bankruptcy experience and corporate risk-taking. Journal of Financial Economics. 2021; 142: 261–292. https://doi.org/10.1016/j.jfineco.2021.04.037

Grant RM. The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. California Management Review. 1991; 33: 114–135. https://doi.org/10.2307/41166664

Greene WH. Econometric Analysis. Prentice Hall: Upper Saddle River. 1997.

Guidara A, Khlif H, Jarboui A. Voluntary and timely disclosure and the cost of debt: South African evidence. Meditari Accountancy Research. 2014; 22: 149–164. https://doi.org/10.1108/medar-09-2013-0042

Gujarati DN. Basic Econometrics. 3rd edn. McGraw-Hill: New York. 1995.

Gul FA, Kim JB, Qiu AA. Ownership concentration, foreign shareholding, audit quality, and stock price synchronicity: Evidence from China. Journal of Financial Economics. 2010; 95: 425–442. https://doi.org/10.1016/j.jfineco.2009.11.005

Guo M, Zheng C. Foreign ownership and corporate social responsibility: Evidence from China. Sustainability. 2021; 13: 508. https://doi.org/10.3390/su13020508

Halid S, Abdul Rahman R, Mahmud R, Mansor N, Abdul Wahab R. A Literature Review on ESG Score and Its Impact on Firm Performance. International Journal of Academic Research in Accounting, Finance and Management Sciences. 2023; 13: 272–282. https://doi.org/10.6007/ijarafms/v13-i1/15101

Handajani L, Husnan LH, Pituringsih E. Impacts of Sustainability Performance and Firm Characteristics on Risk and Corporate Value. Jurnal Economia. 2022; 18: 221–239. https://doi.org/

10.21831/economia.v18i2.42883

Harper Ho VE. Sustainable finance & China's green credit reforms: A test case for bank monitoring of environmental risk. Cornell International Law Journal. 2018; 51: 609–681. https://dx.doi.org/10.2139/ssrn.3124304

He F, Ding C, Yue W, Liu G. ESG performance and corporate risk-taking: Evidence from China. International Review of Financial Analysis. 2023; 87: 102550. https://doi.org/10.1016/j.irfa.2023.102550

Hong X, Ning M, Chen Q, Shi C, Wang N. How does command-and-control environmental regulation impact firm value? A study based on ESG perspective. Environment, Development and Sustainability. 2024; 27: 11477–11508. https://doi.org/10.1007/s10668-023-04366-8

Hu T, You K, Lok CL. State ownership, political connection and ESG performance. Risk Management. 2025; 27: 1. https://doi.org/10.1057/s41283-024-00156-2

Huang G, An Z, Li D. Foreign institutional ownership and corporate risk-taking: International evidence. Corporate Governance: an International Review. 2023; 31: 260–284. https://doi.org/10.1111/corg.12456

Ishtiaq M, Latif K, Khan AN, Noreen R. Corporate Social Responsibility and Firm Performance: The Moderating Effect of Ownership Concentration. Journal of Managerial Sciences. 2017; 11: 353–386.

Jakobsen M, Johan Berg M. The Impact of State Ownership and Regulatory Changes on ESG Performance [master's thesis]. BI Norwegian Business School. 2023.

Jensen MC, Meckling WH. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. In Brunner K (ed.) Economics Social Institutions (pp. 163–231). Springer: Dordrecht. 1979.

Jha RK, Tiwari RK. Institutional Ownership and Corporate Risk-taking: Indian Evidence. Global Business Review. 2025. https://doi.org/10.1177/09721509241310035

Jia F, Li Y, Cao L, Hu L, Xu B. Institutional Shareholders and Firm ESG Performance: Evidence from China. Sustainability. 2022; 14: 14674. https://doi.org/10.3390/su142214674

Jiang Y, Li H, Li Y. Does Institutional Investor Ownership Influence Corporate Cash Holding? In 2021 3rd International Conference on Economic Management and Cultural Industry (ICEMCI 2021) (pp. 78–85). Atlantis Press. 2021.

John K, Litov L, Yeung B. Corporate governance and risk-taking. The Journal of Finance. 2008; 63: 1679–1728. https://doi.org/10.1111/j.1540-6261.2008.01372.x

Kaplan RS, Mikes A. Managing Risks: a New Framework. Harvard Business Review Press: Brighton. 2020.

Kazancoglu I, Sagnak M, Kumar Mangla S, Kazancoglu Y. Circular economy and the policy: A framework for improving the corporate environmental management in supply chains. Business Strategy and the Environment. 2021; 30: 590–608. https://doi.org/10.1002/bse.2641

Khaliq A. Ownership structure and firm performance dynamics in emerging markets. Sustainable Business Management Review. 2024; 1: 69–79. https://doi.org/10.5281/zenodo.13225040

Khamisu MS, Paluri RA, Sonwaney V. Stakeholders' perspectives on critical success factors for environmental social and governance (ESG) implementation. Journal of Environmental Management. 2024; 365: 121583. https://doi.org/10.1016/j.jenvman.2024.121583

Khatib SF. An assessment of methods to deal with endogeneity in corporate governance and reporting research. Corporate Governance: The International Journal of Business in Society. 2025; 25: 606–630. https://doi.org/10.1108/CG-12-2023-0507

Khorilov TG, Kim J. ESG and firm risk: evidence in Korea. Sustainability. 2024; 16: 5388. https://doi.org/10.3390/su16135388

Kim E. The Effect of Foreign Investors on ESG Investment Efficiency: Evidence from South Korea. Sustainability. 2025; 17: 2267. https://doi.org/10.3390/su17052267

Krüger P. Corporate goodness and shareholder wealth. Journal of Financial Economics. 2015; 115: 304–329. https://doi.org/10.1016/j.jfineco.2014.09.008

Landi GC, Iandolo F, Renzi A, Rey A. Embedding sustainability in risk management: The impact of environmental, social, and governance ratings on corporate financial risk. Corporate Social Responsibility and Environmental Management. 2022; 29: 1096–1107. https://doi.org/10.1002/csr.2256

Le TH, Tran-Nam B. Trade liberalization, financial modernization and economic development: An empirical study of selected Asia–Pacific countries. Research in Economics. 2018; 72: 343–355. https://doi.org/10.1016/j.rie.2017.03.001

Leary MT, Roberts MR. Do peer firms affect corporate financial policy? The Journal of Finance. 2014; 69: 139–178. https://doi.org/10.1111/jofi.12094

Lee J, Koh K. ESG performance and firm risk in the US financial firms. Review of Financial Economics. 2024; 42: 328–344. https://doi.org/10.1002/rfe.1208

Lee J, Yang D. The study on effects of foreign ownership on innovation. Entrepreneurship, Innovation, and Strategy. 2016; 24. https://doi.org/10.20849/abr.v1i2.78

Leuz C, Lins KV, Warnock FE. Do Foreigners Invest Less in Poorly Governed Firms? Review of Financial Studies. 2009; 22: 3245–3285. https://doi.org/10.1093/rfs/hhn089

Li Q, Li M, Zhang L. Revisiting the relationship between ESG, institutional ownership, and corporate innovation: An efficiency perspective. Corporate Social Responsibility and Environmental Management. 2024; 31: 6504–6525. https://doi.org/10.1002/csr.2937

Liao E, Jesmin FH. Corporate ownership and firm's ESG performance: A study of Swedish listed firms. 2023.

Lin Z, Zhang Q, Deng C. Multiple Large Shareholders and ESG Performance: Evidence from Shareholder Friction. Sustainability. 2024; 16: 6558. https://doi.org/10.3390/su16156558

Liu EX, Song Y. ESG performance, environmental uncertainty, and firm risk. Journal of International Financial Management & Accounting. 2025; 36: 292–322. https://doi.org/10.1111/jifm.12227

Liu H, Lee H. The Role of Ownership Structure in the Relation-

ship Between Environmental, Social, and Governance Practices and Financial Reporting Quality: Evidence from China. Sustainability. 2024; 16: 10687. https://doi.org/10.3390/su162310687

Liu J, Uchida K, Bao C. Environmental regulation, corporate environmental disclosure, and firm performance: Evidence from China. Pacific-Basin Finance Journal. 2024; 85: 102367. https://doi.org/10.1016/j.pacfin.2024.102367

Lopez-de-Silanes F, McCahery J, Pudschedl P. Institutional Investors and ESG Preferences. Corporate Governance: an International Review. 2024; 32: 1060–1086. https://doi.org/10.1111/corg.12583

Ma F, Cao J. The Chinese equity premium predictability: Evidence from a long historical data. Finance Research Letters. 2023; 53: 103668. https://doi.org/10.1016/j.frl.2023.103668

Maji SG, Lohia P. Environmental, social and governance (ESG) performance and firm performance in India. Society and Business Review. 2023; 18: 175–194. https://doi.org/10.1108/sbr-06-2022-0162

Marquis C, Qian C. Corporate Social Responsibility Reporting in China: Symbol or Substance? Organization Science. 2014; 25: 127–148. https://doi.org/10.1287/orsc.2013.0837

Matakanye RM, Van Der Poll HM, Muchara B. Do companies in different industries respond differently to stakeholders' pressures when prioritising environmental, social and governance sustainability performance?. Sustainability. 2021; 13: 12022. https://doi.org/10.3390/su132112022

Menla Ali F, Wu Y, Zhang X. ESG disclosure, CEO power and incentives and corporate risk-taking. European Financial Management. 2024; 30: 961–1011. https://doi.org/10.1111/eufm.12447

Mi X. The Impact of Firm Ownership on Innovation: Evidence from China [master's thesis]. University of Plymouth. 2023.

Mihet R. Effects of culture on firm risk-taking: a cross-country and cross-industry analysis. Journal of Cultural Economics. 2013; 37: 109–151. https://doi.org/10.1007/s10824-012-9186-2

Myers RH. Classical and modern regression with applications (Vol. 2). Duxbury Press: Belmont. 1990.

Naeem M, Ullah H, Jan S. The impact of ESG practices on firm performance: Evidence from emerging countries. Indian Journal of Economics and Business. 2021; 20: 731–750.

Neubauer R, Blomberg Persson C. Institutional Ownership and Firm Innovation-A Swedish Study on the Impact of Institutional Ownership on R&D Activity [master's thesis]. LUND University. 2023.

Nguyen Thi QN, Tran QT, Doan HP. Foreign ownership, state ownership and cash holdings under the global financial crisis: evidence from the emerging market of Vietnam. International Journal of Emerging Markets. 2023; 18: 3354–3369. https://doi.org/10.1108/ijoem-03-2020-0303

Peliu SA. Exploring the impact of ESG factors on corporate risk: empirical evidence for New York Stock Exchange listed companies. Future Business Journal. 2024; 10: 92. https://doi.org/10.1186/s43093-024-00378-6

Pong HK, Fong CC. Environmental, Social and Governance Awareness and Organisational Risk Perception Amongst Accountants. Journal of Risk and Financial Management. 2024; 17: 480. https://doi.org/10.3390/jrfm17110480

Qian T, Yang C. State-Owned Equity Participation and Corporations' ESG Performance in China: The Mediating Role of Top Management Incentives. Sustainability. 2023; 15: 11507. https://doi.org/10.3390/su151511507

Qu W, Zhang J. Environmental, Social, and Corporate Governance (ESG), Life Cycle, and Firm Performance: Evidence from China. Sustainability. 2023; 15: 14011. https://doi.org/10.3390/su151814011

Radhouane I, Nekhili M, Nagati H, Paché G. Is voluntary external assurance relevant for the valuation of environmental reporting by firms in environmentally sensitive industries? Sustainability Accounting, Management and Policy Journal. 2020; 11: 65–98. https://doi.org/10.1108/sampj-06-2018-0158

Rahman MJ, Rana T, Zhu H, He H. The Impact of Corporate ESG Performance on Financial Performance. Environmental, Social and Governance Accounting and Auditing. 2025; 91–107. https://doi.org/10.4324/9781003488934-7

Rieg R, Ulrich P. Ownership structures as moderators: How they affect management practices and firm outcomes. Corporate Ownership and Control. 2024; 21: 75–88. https://doi.org/10.22495/cocv21i4art7

Roedder F, Schmid S. The impact of foreign ownership on firms: a systematic literature review. Management Review Quarterly. 2026; 76: 1283–1311. https://doi.org/10.1007/s11301-025-00504-w

SAIDANE D, ABDALLAH SB. African firm default risk and CSR. Finance Research Letters. 2021; 43: 101964. https://doi.org/10.1016/j.frl.2021.101964

Sakawa H, Watanabel N, Duppati G, Faff R. Institutional ownership and corporate risk-taking in Japanese listed firms. Applied Economics. 2021; 53: 1899–1914. https://doi.org/10.1080/00036846.2020.1854450

Sallemi N, Zouari G. Board characteristics and takaful performance: the moderating role of ownership concentration. Journal of Islamic Accounting and Business Research. 2024; 16: 1318–1345. https://doi.org/10.1108/jiabr-12-2021-0327

Setiarini A, Gani L, Diyanty V, Adhariani D. Strategic orientation, risk-taking, corporate life cycle and environmental, social and governance (ESG) practices: Evidence from ASEAN countries. Business Strategy & Development. 2023; 6: 491–502. https://doi.org/10.1002/bsd2.257

Shakil MH. Environmental, social and governance performance and financial risk: Moderating role of ESG controversies and board gender diversity. Resources Policy. 2021; 72: 102144. https://doi.org/10.1016/j.resourpol.2021.102144

Sharma R, Mehta K, Dhiman Y, Shkula VK. Crucial Insights into ESG Reporting. Finance, Innovation and Corporate Sustainability. 2025; 139–160. https://doi.org/10.4324/9781003501121-9

Sheikh S. An examination of the dimensions of CEO power and corporate social responsibility. Review of Accounting

and Finance. 2019; 18: 221–244. https://doi.org/10.1108/RAF-01-2018-0034

Shleifer A, Vishny RW. Large Shareholders and Corporate Control. Journal of Political Economy. 1986; 94: 461–488. https://doi.org/10.1086/261385

Singhania M, Gupta D. Impact of Environmental, Social and Governance (ESG) disclosure on firm risk: A meta-analytical review. Corporate Social Responsibility and Environmental Management. 2024; 31: 3573–3613. https://doi.org/10.1002/csr.2725

Song J, Wei Y, Wang R. Market orientation and innovation performance: The moderating roles of firm ownership structures. International Journal of Research in Marketing. 2015; 32: 319–331. https://doi.org/10.1016/j.ijresmar.2015.03.005

Subastian LU, Setiawan D. Does foreign ownership structure increase Indonesian firms' risk-taking? Jurnal Ekonomi Dan Bisnis. 2022; 25: 59–70. https://doi.org/10.24914/jeb.v25i1.4952

Sun C, Lu S, Zhang Y. How components of ESG performance impact corporate risk-taking? Frontiers in Sustainable Energy Policy. 2024; 3: 1493355. https://doi.org/10.3389/fsuep.2024.1493355

Tan X, Liu G, Cheng S. How does ESG performance affect green transformation of resource-based enterprises: Evidence from Chinese listed enterprises. Resources Policy. 2024; 89: 104559. https://doi.org/10.1016/j.resourpol.2023.104559

Usman M, Xiao S, Ashraf RU, Lian F. Role of ownership structure in firm R&D investment decision: Evidence from Chinese high-tech industry. In 2017 4th International Conference on Industrial Economics System and Industrial Security Engineering (IEIS) (pp. 1–5). IEEE. 2017.

van Duuren E, Plantinga A, Scholtens B. ESG Integration and the Investment Management Process: Fundamental Investing Reinvented. Journal of Business Ethics. 2016; 138: 525–533. https://doi.org/10.1007/s10551-015-2610-8

Villalonga B, Tufano P, Wang B. Corporate ownership and ESG performance. Journal of Corporate Finance. 2025; 91: 102732. https://doi.org/10.1016/j.jcorpfin.2024.102732

Vuong GTH, Nguyen PV, Barky W, Nguyen MH. Stock return volatility and financial distress: Moderating roles of ownership structure, managerial ability, and financial constraints. International Review of Economics & Finance. 2024; 91: 634–652. https://doi.org/10.1016/j.iref.2024.01.054

Wang Y, Wang X. From ratings to action: The impact of ESG performance on corporate innovation. Heliyon. 2024; 10: e26683. https://doi.org/10.1016/j.heliyon.2024.e26683

Wei M, Wang Y, Giamporcaro S. The impact of ownership structure on environmental information disclosure: Evidence from China. Journal of Environmental Management. 2024; 352: 120100. https://doi.org/10.1016/j.jenvman.2024.120100

Widianingsih YPN, Setiawan D, Aryani YA, Gantyowati E. The Relationship between Innovation and Risk Taking: The Role of Firm Performance. Risks. 2023; 11: 144. https://doi.org/10.3390/risks11080144

Wu L, Yi X, Hu K, Lyulyov O, Pimonenko T. The effect of ESG performance on corporate green innovation. Business Process Management Journal. 2025; 31: 24–48. https://doi.org/10.1108/BPMJ-04-2023-0237

Wu S, Li X, Du X, Li Z. The Impact of ESG Performance on Firm Value: The Moderating Role of Ownership Structure. Sustainability. 2022; 14: 14507. https://doi.org/10.3390/su142114507

Wu S, Zhang H, Wei T. Corporate Social Responsibility Disclosure, Media Reports, and Enterprise Innovation: Evidence from Chinese Listed Companies. Sustainability. 2021; 13: 8466. https://doi.org/10.3390/su13158466

Wu Z, Pownall R, Shih YC, Zhang C. State ownership and the value of sustainability: Evidence from China. International Review of Financial Analysis. 2025; 102: 104142. https://doi.org/10.1016/j.irfa.2025.104142

Xie L, Peng Z, Tong X, Zhou W. ESG disclosure and financing constraints: Evidence from Chinese listed firms. Economic Analysis and Policy. 2026; 89: 742–756. https://doi.org/10.1016/j.eap.2025.12.040

Xu J, Liu F, Shang Y. R&D investment, ESG performance and green innovation performance: evidence from China. Kybernetes. 2021; 50: 737–756. https://doi.org/10.1108/k-12-2019-0793

Yavuz MS, Tatlı HS, Bozkurt G, Öngel G. Does ESG performance have an impact on financial performance? Evidence from Turkey. Journal of Entrepreneurship, Management and Innovation. 2025; 21: 24–42. https://doi.org/10.7341/20252112

Zeng T, Lin H. Ownership structure and R&D spending: evidence from China's listed firms. Chinese Management Studies. 2011; 5: 82–93. https://doi.org/10.1108/17506141111118471

Zhang J, Wu W. The impact of foreign ownership on corporate ESG performance. Finance Research Letters. 2024; 66: 105602. https://doi.org/10.1016/j.frl.2024.105602

Zhang X, Li W, Ji T, Xie H. The impact of ESG performance on firms' technological innovation: evidence from China. Frontiers in Environmental Science. 2024; 12: 1342420. https://doi.org/10.3389/fenvs.2024.1342420

Zheng X, Zhu B, Yang G. The soft landing: Does intrafamily succession matter for corporate risk-taking? Pacific-Basin Finance Journal. 2023; 78: 101967. https://doi.org/10.1016/j.pacfin.2023.101967

Zhou X, Nian S. Sustainable Pathways: ESG Disclosure Performance and Optimization in China. Sustainability. 2024; 16: 4630. https://doi.org/10.3390/su16114630

Zhu C, Yang C. Divergences among ESG rating systems: Evidence from financial indexes. Economic Analysis Letters. 2024; 3: 46–51. https://doi.org/10.58567/eal03010006