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RESEARCH ARTICLE

ESG's Impact on Chinese-Listed Firms' Value: Second-Order Moderation Analysis of Financial Constraint and CEO Duality

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ABSTRACT

As firms increasingly integrate ESG practices into their corporate strategies, their impact on firm value remains contentious. While ESG initiatives can enhance stakeholder trust and operational efficiency, their financial benefits may be constrained by resource limitations and leadership dynamics. This study investigates the relationship between ESG performance and firm value in Chinese A-share-listed companies from 2014 to 2023, emphasizing the moderating roles of financial constraints and CEO duality. Drawing on Stakeholder Theory and Upper Echelon Theory, this study explores how financial constraints limit firms' ability to derive value from ESG initiatives, while CEO duality further moderates this relationship. Using panel data analysis with the Fixed Effects Model and robust standard errors, the findings reveal that ESG performance negatively influences the P/B ratio and Tobin's Q, with an insignificant effect on EVA. Financial constraints weaken ESG's positive impact on firm value, particularly for Tobin's Q, reflecting short-term financial pressures. However, CEO duality's second-order moderation was insignificant, suggesting that leadership structure may not substantially alter this dynamic. These findings highlight the importance of aligning ESG strategies with firms' financial capacities to ensure effective value creation. Firms should prioritize ESG initiatives that offer measurable outcomes, while policymakers may consider targeted subsidies or incentives to support financially constrained firms. Strengthening independent governance structures can further enhance ESG integration and long-term performance. This study offers practical insights for investors, corporate leaders, and policymakers seeking to balance sustainability with financial outcomes in China's evolving market landscape.

Contribution/Originality: This study contributes to the existing literature by exploring the ESG–firm value relationship using a second-order moderation

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framework. This study uses a new estimation methodology and documents how financial constraints and CEO duality jointly moderate ESG outcomes, offering novel insights into governance and sustainability trade-offs in Chinese A-share-listed companies.

1. Introduction

In the rapidly evolving global marketplace, transparency and sustainability in corporate operations are more essential than ever. Investors and stakeholders increasingly demand Environmental, Social, and Governance (ESG) disclosure beyond financial results (Gholami et al., 2022). This shift has fueled the rise of Socially Responsible Investing (SRI), where investment decisions are influenced by a company's ESG performance. Given China's rapid industrialization and its associated environmental and social challenges, integrating ESG practices into corporate strategies has become imperative (Dawei & Latiff, 2024).

High-quality development has been a core economic strategy in China, as emphasized in the 2022 Twentieth National Congress. The Dual Carbon policy has emerged as a key driver of ESG performance, serving as a primary catalyst for sustainable growth among Chinese companies (Zheng & Bu, 2024). Achieving this transformation requires a shift from traditional extensive models to a more balanced approach that integrates economic, social, and environmental benefits (Lu et al., 2025). As key contributors to national progress, enterprises play a crucial role in advancing sustainable development. Stakeholder theory further supports this perspective, arguing that firm value is not solely derived from maximizing shareholder wealth but also from fostering strong relationships with stakeholders, including customers, suppliers, employees, and communities (Li et al., 2018). Effective stakeholder engagement enhances operating performance, reduces agency costs, and ultimately increases firm value, reinforcing the importance of ESG-driven strategies in corporate governance.

Several studies have examined the industry-specific relationship between ESG performance and corporate value. For example, Paolone et al. (2022) found a significant positive correlation between governance quality (G) and corporate value in publicly listed pharmaceutical companies in Italy. Similarly, Chinese scholars Ma (2019), Xu et al. (2022), and Wang and Yang (2022) provided empirical evidence that stronger ESG performance is associated with higher corporate value, particularly in heavily polluting industries, where the benefits of ESG initiatives are even more pronounced. While these findings highlight the value-enhancing potential of ESG practices, the extent of their impact may depend on a firm's financial capacity to support sustainable initiatives.

While ESG performance positively influences firm value by enhancing stakeholder trust, reducing risk, and improving operational efficiency, its impact may be constrained by a firm's financial resources. Firms with limited access to capital may struggle to implement ESG initiatives effectively, potentially weakening the expected benefits (Kurtanović & Kadušić, 2024; Miranda-García, & Segovia-Vargas, 2024). Financial constraints can restrict a company's ability to invest in sustainability projects, adopt green technologies, or enhance corporate governance practices, thereby moderating the relationship between ESG performance and firm value (Ariff et al., 2024; Chen et al., 2024). Understanding this dynamic is crucial for assessing how firms navigate the trade-

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off between financial limitations and long-term value creation through ESG commitments.

While financial constraints can limit the benefits of ESG performance, their impact may depend on leadership structure. CEO duality, where the CEO also serves as board chair, can either mitigate or amplify these constraints, shaping how ESG influences firm value (Wu et al., 2023; Prayogo et al., 2024). CEO duality can weaken the effectiveness of governance mechanisms, such as audit committees, which are crucial for financial transparency and reducing the cost of equity capital. This is particularly evident in emerging markets like Jordan, where CEO duality diminishes the audit committee's ability to mitigate equity costs, thereby potentially exacerbating financial constraints (Ananzeh, 2024). In the context of firm performance, CEO duality has been shown to negatively affect financial outcomes, as seen in Pakistani firms. This negative impact is mediated by board effectiveness, suggesting that financial constraints could be more pronounced when CEO duality is present, due to reduced board independence and oversight (Ali et al., 2022).

Given these complexities, this study examines the relationship between ESG performance and firm value in Chinese A-share-listed companies (2014–2023), addressing the dual challenge of voluntary ESG disclosure and its financial implications. While ESG initiatives are widely recognized for their potential benefits, their impact on firm value is shaped by financial constraints and governance structures. To capture these dynamics, this study employs a second-order moderation framework, analyzing how financial constraints (first-order moderator) influence the ESG–firm value relationship and how CEO duality (second-order moderator) further shapes this effect.

Stakeholder Theory underscores the importance of ESG performance in balancing the interests of investors, employees, and regulators. However, financial constraints may limit firms' ability to invest in ESG initiatives, creating tension between short-term financial pressures and long-term sustainability goals. CEO duality adds complexity, as a powerful CEO may either drive ESG adoption or prioritize financial stability at the expense of sustainability. Upper Echelon Theory (UET) further explains how leadership structure influences strategic decision-making. Under financial constraints, CEO duality may weaken ESG's impact on firm value due to centralized control and limited oversight. Conversely, in financially stable firms, a strong CEO may enhance ESG-driven financial gains by aligning sustainability with corporate strategy.

This study's novel second-order moderation approach advances ESG–performance research by considering the interplay between financial constraints and governance mechanisms within China's evolving regulatory and economic landscape. While previous studies highlight ESG's financial benefits, few have explored how these factors jointly influence firm value. As China places greater emphasis on sustainable corporate strategies, this research offers practical insights for investors, policymakers, and corporate leaders, providing recommendations to enhance ESG adoption, improve governance, and strengthen firm valuation in China's capital markets.

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2. Literature Review

2.1. Influence of ESG on Corporate Value

The growing emphasis on ESG in corporate sustainability has sparked debate over whether firms prioritizing environmental, social, and governance factors can enhance their overall value (Meini & Setijaningsih, 2024; Lerskullawat & Ungphakorn, 2024; Wang et al., 2024; Liu et al., 2023). Over time, researchers have explored the link between ESG performance and firm value across different industries and regions, yielding diverse findings. While some studies highlight a positive impact, emphasizing risk reduction, improved stakeholder trust, and long-term profitability, others argue that ESG commitments may impose financial burdens, particularly for resource-constrained firms. This ongoing debate underscores the need for further investigation to clarify the conditions under which ESG contributes to firm value, particularly in emerging markets like China.

Numerous studies have consistently shown that ESG performance positively impacts firm value across various regions. For instance, research on companies in Indonesia and Singapore found that higher ESG performance enhances firm value, with a stronger effect in Indonesia (Meini & Setijaningsih, 2024). Similarly, studies on ASEAN-5 countries (Thailand, Indonesia, Malaysia, the Philippines, and Singapore) confirmed a positive correlation between ESG performance and firm value, particularly in Indonesia and Malaysia (Lerskullawat & Ungphakorn, 2024). Moreover, ESG-driven technological advancements, such as digital intelligence and green innovation, further reinforce this relationship by improving both sustainability practices and corporate value (Zhou, 2024).

In the Chinese context, extensive research supports the value-enhancing role of ESG performance. Liu et al. (2023), analyzing A-share listed firms (2010–2022), found that ESG consistently contributes to value creation across all manufacturing sub-sectors. Xu et al. (2022) highlighted that high-quality ESG disclosures improve stock returns, reduce information asymmetry, and attract stakeholders, ultimately strengthening financial performance. Additionally, firms with strong ESG practices enjoy lower credit risk, higher investor confidence, and greater profitability in social investments (Liu et al., 2023). ESG-driven companies in China also prioritize green innovation, aligning with national sustainability goals while enhancing competitiveness (Sun et al., 2019; Wang et al., 2021).

The impact of ESG performance on firm value is not uniform across all regions and industries. For example, a study comparing emerging and developed markets found that while ESG performance generally enhances firm value in Indonesia, the relationship is influenced by regulatory frameworks and investor awareness. In developed markets, robust regulatory systems and investor demand for ESG integration amplify the positive impact of ESG on firm value, whereas in Indonesia, the relationship is more nuanced and influenced by socioeconomic factors (Syarkani et al., 2024). Industry differences also play a role in the ESG-firm value relationship. A study on non-financial companies in Southeast Asia found that ESG performance impacts firm value more significantly when companies are in the mature stage of their life cycle. This suggests that the effects of ESG performance may not be immediately apparent but rather manifest over time (Xaviera et al., 2024).

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While the majority of studies suggest a positive relationship between ESG performance and firm value, some research presents contradictory findings. For example, a study on non-financial companies in Indonesia found that higher ESG scores are associated with lower firm value, particularly in the environmental and governance pillars. This suggests that in certain contexts, high ESG performance may be perceived as a cost rather than a value-enhancing factor (Yori & Rahmawati, 2025). Similarly, Wang et al. (2024) found that while high-quality ESG improves a firm's book value, it significantly reduces market value. Buallay (2019) observed that social (S) factors negatively affect ROA, ROE, and Tobin's Q, while governance (G) weakens ROA and ROE in publicly listed banks. Shareholder theory further argues that excessive ESG investments may serve managerial interests at the expense of shareholders. Zhou (2022) proposed a U-shaped relationship, where initial ESG investments reduce profitability due to resource misallocation but later enhance long-term financial performance. Other studies (Landi, & Sciarelli, 2019; Garcia & Orsato, 2020; Duque-Grisales & Aguilera-Caracuel, 2021) also report a negative ESG-financial performance link.

Conversely, some scholars argue that ESG and corporate value share no significant relationship. Studies by Angir and Weli (2024) and Atan et al. (2018) found no meaningful connection between ESG performance and firm value. Likewise, Almeyda and Darmansyah (2019) observed no clear link between ESG and stock prices or price-to-earnings ratios, suggesting that ESG's financial impact may be context-dependent. Given these mixed findings, the relationship between ESG performance and corporate value remains a topic of debate.

This study aims to assess the extent to which ESG initiatives influence firm value, considering both the potential benefits and limitations identified in prior research. By examining different dimensions of ESG across industries and markets, this study seeks to provide deeper insights into the mechanisms driving the ESG-corporate value relationship. Thus, the study proposes the following hypothesis:

H1: ESG performance has a significant effect on corporate value.

2.2. Financial Constraints influence ESG disclosure and Firm Value

Capital is the backbone of any enterprise striving for long-term success. However, meeting ESG responsibilities requires substantial financial resources (Zhu, 2024). Many scholars have highlighted financing constraints as a critical factor shaping the ESG-performance relationship. These constraints can directly and indirectly impact a firm's ability to invest in ESG initiatives, affecting both market value and overall financial performance (Abubakar et al., 2024; Ariff et al., 2024; Kurtanović & Kadušić, 2024). While financial constraints can limit ESG investments, strong ESG performance can, in turn, ease financial pressures and enhance firm value.

Ariff et al. (2024) explored this dynamic by investigating how corporate tax avoidance influences ESG performance, with financial constraints acting as a moderating factor. Using a global dataset of 24,259 firm-year observations from 49 countries (2011–2020), they found that firms engaging in higher tax avoidance tend to perform better in ESG. However, firms facing financial constraints struggle to maintain strong ESG performance, and the positive impact of tax avoidance on ESG diminishes under such conditions. Similarly, Miranda-García and Segovia-Vargas (2024) examined the relationship between financial constraints and ESG performance in 227 European

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bioeconomy firms. Their findings reveal that financial constraints—driven by profitability (ROE and ROA) and indebtedness—significantly affect ESG performance and firm value. Notably, firms that fail to disclose ESG results face heightened funding challenges, suggesting that poor ESG practices can restrict access to capital. On the other hand, improving ESG performance alongside financial health can enhance a firm's ability to secure funding, support better decision-making, and ultimately drive higher firm value.

Financial constraints have also been shown to hinder firm performance more broadly. Ng et al. (2024) found that financial constraints negatively impact firm performance in non-financial firms across the ASEAN-5 countries (Indonesia, Malaysia, Singapore, Thailand, and the Philippines) from 2011 to 2019. Using the Kaplan-Zingales (KZ) and Whited and Wu (WW) indexes to measure financial constraints, they found that while financial constraints generally reduce firm performance, the adverse effects can be mitigated through ESG engagement. However, during economic downturns, financial constraints become more pronounced. For example, during the COVID-19 pandemic, financial limitations significantly worsened the performance of Chinese tourism companies, particularly small-scale and private enterprises, amplifying the negative impact of external shocks on firm sustainability (Chen et al., 2024). This finding corroborates with Shelih and Wang (2023) in the context of Egyptian firms.

Ding et al. (2024) further analyzed the role of financial constraints as a moderator between ESG ratings and total factor productivity (TFP) in 1,305 heavily polluting Chinese enterprises listed on the Shanghai and Shenzhen A-shares (2012–2022). Their findings suggest that firms facing financial constraints struggle to leverage ESG performance for value creation. Using a two-way fixed-effects model, the study shows that financial constraints limit a firm's ability to invest in R&D and effectively implement ESG strategies, thereby reducing productivity and firm value. This highlights the critical role of financial access in maximizing ESG-related benefits.

These insights align with Shang (2024), who found that strong ESG performance can help alleviate financial constraints, ultimately improving financial outcomes. Companies with robust ESG practices tend to experience better financial performance, particularly non-state-owned enterprises, and firms not under strict pollution monitoring. While financial constraints generally suppress firm value, effective ESG strategies can counterbalance these challenges, enhancing financial resilience. The study further suggests that the benefits of ESG are more pronounced in firms with lower regulatory oversight, though advantages extend across different ownership structures and industries.

Collectively, these findings underscore the moderating role of financial constraints in the ESG-performance relationship. While financial limitations can restrict a firm's ability to invest in ESG, a strong ESG strategy can, in turn, ease financial constraints by improving investor confidence, reducing capital costs, and enhancing firm value. Thus, addressing financial barriers is key to unlocking the full potential of ESG initiatives in driving sustainable corporate success. Thus:

H2: Financial constraint moderates the effect of ESG on corporate value.

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2.3. Influencing Effect of CEO Duality

Upper Echelon Theory (UET) posits that executives' characteristics, experiences, and cognitive biases shape strategic decisions and organizational outcomes (Hambrick & Mason, 1984 cited in Neumeyer et al., 2023). In this context, CEO duality, where the CEO also serves as the board chair, plays a significant role in shaping a firm's strategic decisions, particularly when financial constraints are present (Wu et al., 2023; Prayogo et al., 2024). This concentration of authority can be particularly influential when financial constraints (FC) challenge firms' ability to allocate resources effectively. Under UET, CEOs with dual roles may prioritize personal strategic preferences over collective governance mechanisms, influencing corporate financial and ESG performance.

Both Ananzeh (2024) and Velte (2019) highlight the moderating effect of CEO duality on corporate governance, emphasizing how a single executive holding excessive control can significantly impact financial outcomes. Ananzeh (2024) examined the influence of CEO duality on the relationship between audit committee independence (ACI) and CEC in Jordanian publicly listed companies. Using data from 2014 to 2018, the study found that independent audit committees help lower CEC, enhance financial transparency, and strengthen investor confidence. However, their effectiveness is significantly weakened when the CEO also serves as board chair, limiting the audit committee's ability to mitigate equity costs. This finding underscores the governance challenges that arise when a single executive holds excessive decision-making power, reducing effective oversight. Similarly, Velte (2019) explored how CEO power moderates the relationship between ESG performance and financial performance in Germany's two-tier board system (HDAX and SDAX), analyzing 775 firm-year observations from 2010–2018. The study found that strong ESG performance positively impacts financial performance, and this relationship is even stronger when the CEO has a dual role. In contrast to Ananzeh's (2024) findings, Velte (2019) suggests that in certain contexts, CEO incentives can enhance ESG-driven financial gains, reinforcing the CSR-business case even in governance structures where CEOs hold significant control. The study's conclusions remained robust after multiple validation checks.

In the context of firm performance from a developing country's perspective, Ali et al. (2022) found that CEO duality negatively affects financial outcomes, as seen in 163 Pakistani-listed firms. This negative impact is mediated by board effectiveness, suggesting that financial constraints could be more pronounced when CEO duality is present, due to reduced board independence and oversight. CEO duality can further complicate the negative effects of financial constraints on managerial decision-making and risk management, ultimately increasing the likelihood of stock price crashes. Shelih and Wang (2023) found that in Egyptian firms, financial constraints significantly weaken the ability of managerial skills to prevent stock price crashes. When the CEO also serves as the board chair, this concentration of power may further limit effective oversight and strategic flexibility, exacerbating the risks associated with financial constraints.

In China, CEO duality can influence the prioritization of corporate strategies under financial constraints. For instance, in the context of environmental behavior, financial constraints lead to higher emissions and lower innovation, particularly in A-share listed companies from the heavy pollution industry in China from 2008 to 2019. CEO duality might exacerbate these issues by limiting strategic flexibility and responsiveness to regulatory pressures (Liu & Xu, 2024).

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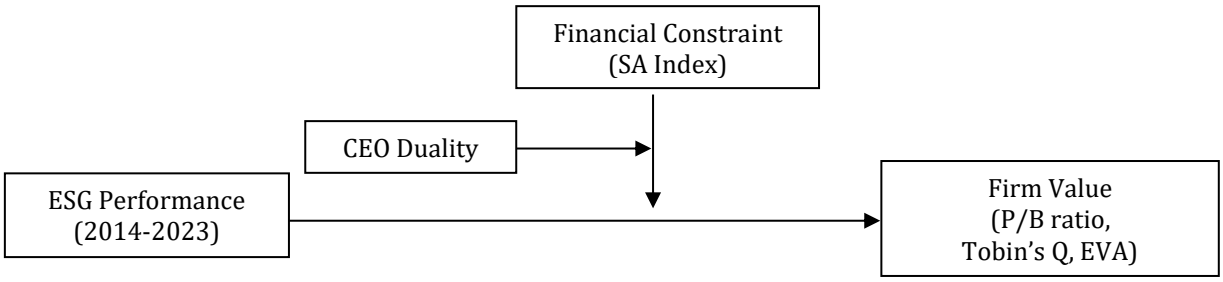
These studies collectively highlight the complex role of CEO duality in shaping financial and ESG outcomes under financial constraints. Guided by UET, firms with centralized leadership may experience either amplified ESG benefits or increased financial vulnerabilities, depending on the strategic priorities of the CEO. While some findings (e.g., Velte, 2019) suggest that CEO power can enhance ESG-related financial performance, others (e.g., Ananzeh, 2024; Ali et al., 2022; Shelih & Wang, 2023) demonstrate that excessive executive control can undermine governance effectiveness, restrict oversight, and exacerbate financial constraints' negative impacts. With this, the study hypothesizes that:

H3: CEO duality moderates the moderating effect of financial constraint on the ESG – firm value relationship.

Figure 1 illustrates the conceptual framework underpinning this study.

Figure 1. Conceptual framework of the study



3. Research Methods

3.1. Data Sources and Measurement

This study examines A-share-listed Chinese firms from 2014 to 2023, applying a rigorous data selection process. Firms with missing data, financial companies, and *ST/ST enterprises were excluded to ensure data integrity and reliability. Winsorization at the 1st and 99th percentiles was applied to control for outliers, resulting in 31,036 valid observations.

Following Ye et al. (2023) and Liu et al. (2023), ESG performance data from Sino-Securities Index Information Service (Shanghai) Co., Ltd was used to assess environmental disclosure. These ratings align with China's environmental policies and industry characteristics, with ESG indicator weights varying by sector. In high-pollution industries like energy and raw materials, the Environmental dimension receives greater emphasis (over 30%), while Social Responsibility and Governance are weighted at no more than 25% and 40%, respectively.

This study defines firm value as a multidimensional concept measured through both accounting- and market-based metrics. While previous studies have used indicators such as profitability, asset turnover, and net profit growth, these may not fully capture a firm's true value and sustainability. To address this, the study adopts the Price-to-Book Ratio (P/B), Tobin's Q, and Economic Value Added (EVA) as key indicators. Tobin's Q offers a forward-looking view by comparing market valuation to asset replacement costs, while P/B reflects investor perception of intrinsic worth. EVA provides a

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comprehensive measure by assessing returns beyond the firm's cost of capital, integrating both financial and non-financial aspects. The formula for calculating EVA is:

$$EVA = NOPAT - (WACC\ x\ TC)$$

where: NOPAT stands for net operating profit after tax; WACC denotes weighted average cost of capital; TC represents total invested capital. By incorporating these three indicators, this study ensures a balanced approach that captures both short-term financial performance and long-term value creation, offering a more holistic evaluation of firm value in the context of ESG performance.

This study employs the SA Index, introduced by Hadlock and Pierce (2010, cited in Ahamed & Houqe, 2023), to measure financial constraints as a first-order moderator. The index is calculated as:

$$SA\ Index = -0.737 * Size + 0.043 * Size^2 - 0.040 * Age$$

where Size is the natural logarithm of total assets, and Age is the number of years since the firm's establishment. Unlike the KZ and WW indexes, which rely on volatile financial variables like cash flow and leverage, the SA Index focuses solely on firm size and age, making it more stable and less prone to misclassification. Empirical evidence confirms that small and young firms face greater financial constraints than larger, established firms, reinforcing the index's reliability. Its stability and long-term applicability make it particularly useful for panel data analysis, providing a consistent and policy-relevant tool for identifying constrained firms and guiding financial support strategies (Ahamed & Houqe, 2023).

Lastly, this study incorporates CEO duality as a key governance variable to examine its potential influence on ESG performance, firm value, and financial constraints. Given its significance, this study includes CEO duality as a second-order moderator, recognizing its potential impact on financial outcomes and governance efficiency. CEO duality is measured as a binary variable, assigned 1 if the CEO and board chair roles are combined and 0 if they are separate. This data is collected from corporate governance disclosures, annual reports, and financial databases, ensuring accuracy and consistency. Since governance structures may evolve, CEO duality is treated as a time-varying variable in the panel data analysis, allowing for a dynamic assessment of its impact on firm performance.

To better capture the intrinsic relationship among research variables, it is crucial to account for additional factors that influence firm value. Based on established literature, this study includes firm size (SIZE), firm age (AGE), property rights (RIGHTS), and board size (BOARD) as control variables. Additionally, industry and year-fixed effects are incorporated through industry and annual dummy variables to mitigate unobserved heterogeneity and enhance the robustness of the findings.

3.2. Model Specification

The impact of ESG performance on firm value (H1) is examined using the Fixed Effects Model (FEM) or Random Effects Model (REM), depending on the results of the Hausman test. These panel regression models are well-suited for controlling unobserved heterogeneity across firms, ensuring more consistent and reliable estimates. FEM is

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particularly effective in addressing omitted variable bias when time-invariant characteristics are correlated with the explanatory variables, while REM assumes that these unobserved effects are uncorrelated with the regressors (Zhu & Manansala, 2024; Manansala & Valerio, 2024).

The following equation was used to examine H1:

For FEM

$$Value_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \gamma Control_{i,t} + \varepsilon_{i,t}$$

For REM

$$Value_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \gamma Control_{i,t} + \mu_i + \varepsilon_{i,t}$$

where, $Value_{i,t}$ represents the firm value, either P/B, Tobin's Q, or EVA of firm i in time period t; $ESG_{i,t}$ denotes the ESG performance of firm i in time period t; $Value_{i,t-1}$is the lagged firm value to account for dynamic effects; α_i represents firm-specific fixed effects; μ_i represents firm-specific random effects; β_0 is the intercept term while β_1, β_2, and γ are the coefficients to be estimated, and $\varepsilon_{i,t}$ is the error term.

In line with prior research emphasizing the role of financial constraints in the ESG-performance relationship, this study examines the moderating role of financial constraints on the ESG-firm value nexus (H2). Using FEM/ REM, the equation for this moderated model is expressed as:

For FEM

$$Value_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \beta_3 FC_{i,t} + \beta_4 (ESG_{i,t} x\, FC_{i,t}) + \gamma Control_{i,t} + \varepsilon_{i,t}$$

For REM

$$Value_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \beta_3 FC_{i,t} + \beta_4 (ESG_{i,t} x\, FC_{i,t}) + \gamma Control_{i,t} + \mu_i + \varepsilon_{i,t}$$

where, $FC_{i,t}$ represents the financial constraint of firm i in time period t; $(ESG_{i,t} x\, FC_{i,t})$ denotes the interaction term to capture the moderating effect (first-order); β_3 and β_4, are additional coefficients to be estimated, and $\varepsilon_{i,t}$ is the error term.

Building on the Upper Echelons Theory (UET) framework, this study investigates the potential influence of CEO duality as a second-order moderator. CEO duality may alter the effect of financial constraints on the ESG-firm value relationship. The equation used to test this model is:

For FEM

$$Value_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \beta_3 FC_{i,t} + \beta_4 (ESG_{i,t} x\, FC_{i,t}) + \beta_5 CEO_{i,t} + \beta_6 (FC_{i,t} x\, CEO_{i,t}) + \beta_7 (ESG_{i,t}\, x\, FC_{i,t}\, x\, CEO_{i,t}) + \gamma Control_{i,t} + \mu_i + \varepsilon_{i,t}$$

For REM

$$Value_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Value_{i,t-1} + \beta_3 FC_{i,t} + \beta_4 (ESG_{i,t} x\, FC_{i,t}) + \beta_5 CEO_{i,t} + \beta_6 (FC_{i,t} x\, CEO_{i,t}) + \beta_7 (ESG_{i,t}\, x\, FC_{i,t}\, x\, CEO_{i,t}) + \gamma Control_{i,t} + \mu_i + \varepsilon_{i,t}$$

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where, $CEO_{i,t}$ represents the dummy variable (1 if the CEO is also the Chairperson, 0 otherwise); ($FC_{i,t} x\ CEO_{i,t}$) signify the second-order interaction term to capture the moderating effect of CEO duality on financial constraint; ($ESG_{i,t}\ x\ FC_{i,t}\ x\ CEO_{i,t}$) denotes the three-way interaction tests - whether CEO duality strengthens or weakens the moderating effect of financial constraint); β_5, β_6, and β_7, are additional coefficients to be estimated, and $\varepsilon_{i,t}$ is the error term.

Diagnostic tests were conducted to assess model suitability, including the Variance Inflation Factor (VIF) for multicollinearity, the Breusch-Pagan test for heteroskedasticity, the Wooldridge test for autocorrelation, and the Fisher-type test for stationarity. As heteroskedasticity and autocorrelation were detected, Robust Standard Errors (RSE) will be applied to improve the reliability of the coefficient estimates.

4. Results

This section presents the findings of the study, beginning with a detailed description of the dataset and the results of diagnostic tests to assess data suitability for panel regression analysis. These preliminary results provide the foundation for the subsequent hypothesis testing and interpretation of key relationships.

Table 1 presents data to ensure a more reasonable distribution and mitigate the influence of extreme values, firm size is measured as the natural logarithm of total assets, following the approach of Deswanto and Siregar (2018), Aluchna et al. (2022), Bissoondoyal-Bheenick (2023), and Ghitti et al. (2024). The use of logarithm helps normalize the data and allows for a more meaningful comparison across firms. EVA is scaled by 1 billion (EVA/1,000,000,000) to enhance readability and mitigate computational issues arising from large values. This transformation does not alter the relative relationships between variables but improves result interpretation.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
PB	31036	3.639	3.403	.517	22.844
Tobin`s Q	31036	2.081	1.368	.83	8.888
EVA	31036	.072	.849	-3.154	4.926
ESG	31036	68.184	8.543	42.72	87.65
SA	31036	-3.89	.252	-4.555	-3.221
CEO duality	31036	.312	.463	0	1
Property rights	31036	.317	.465	0	1
Board size	31036	8.365	1.63	4	18
Firm age	31036	19.899	5.925	4	65
Firm size	31036	22.167	1.344	14.942	28.636

The diagnostic tests reveal important insights about the data's characteristics and guide the appropriate model selection. The multicollinearity test, as shown in Table 2, indicates no severe multicollinearity concerns. All VIF values are below the common threshold of 10, with the highest values observed for Firm Age (4.35) and SA Index (4.18). Despite being relatively higher than other variables, these values remain within acceptable limits. The mean VIF of 2.08 further supports the absence of

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multicollinearity, ensuring the independent variables can be reliably included in the regression model without distortion.

Table 3 reveals heteroskedasticity (Breusch-Pagan test) and autocorrelation (Wooldridge test) in all dependent variables, both confirmed by significant p-values (< .001). The Fisher unit root test confirms stationarity, eliminating the need for differencing. To address these issues, robust standard errors are applied to ensure reliable and accurate estimates.

Table 2: Diagnostic Test for Multicollinearity

Independent Variables	VIF	1/VIF
ESG	1.04	0.958
SA	4.18	0.239
CEO duality	1.14	0.878
Firm size	1.35	0.738
Firm age	4.35	0.230
Board size	1.15	0.870
Property rights	1.35	0.742
Mean VIF	2.08	

Table 3: Diagnostic Tests for Heteroscedasticity, Autocorrelation, and Stationarity

Test	Dependent Variable	Test Statistics	p-value
Breusch-Pagan Test (chi^2)	PB	1.30×10^8	.000
	Tobin's Q	1.12×10^9	.000
	EVA	3.84×10^8	.000
Wooldridge Test (F)	PB	1202.81	.000
	Tobin's Q	1836.24	.000
	EVA	445.52	.000
Fisher Unit Root	PB	-	.000
	Tobin's Q	-	.000
	EVA	-	.000

The Hausman test results presented in Table 4 indicate that the FEM is the appropriate choice for all three dependent variables: P/B Ratio, Tobin's Q, and EVA. The test yielded large chi-squared values (χ^2 = 7316.02, 8571.09, and 4463.86, respectively) with corresponding p-values < .001. Since these p-values are below the 0.05 significance threshold, the null hypothesis — which assumes that the REM is more efficient — is rejected in favor of FEM.

Table 4: Hausman Test Results

Variable	Chi-squared (χ^2)	Prob.	Model Preference
PB	7316.02	.000	FEM
Tobin's Q	8571.09	.000	FEM
EVA	4463.86	.000	FEM

The preference for FEM suggests that unobserved firm-specific characteristics that remain constant over time are correlated with the independent variables. FEM effectively controls for this potential bias, improving the model's reliability.

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Given the earlier diagnostic tests confirming the presence of heteroskedasticity and autocorrelation, conventional standard errors may produce inefficient estimates. To address these issues, applying RSE in the FEM framework is recommended. RSE will enhance the precision of your coefficient estimates and ensure that your statistical inferences remain valid.

4.1. Impact of ESG Performance on Firm Value

This study aims to test the proposed hypotheses by analyzing the impact of ESG performance on firm value. Table 5 presents the FEM regression results, which incorporate the identified model specifications and account for potential diagnostic concerns.

Table 5: FEM Regression Results for the Impact of ESG Performance on Firm Value

Predictors	**P/B**			**Tobin's Q**			**EVA**		
	β	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**
$Value_{t-1}$	0.314	.014	.000	0.295	.011	.000	0.452	.024	.000
ESG	-0.015	.003	.000	-0.003	.001	.004	0.001	.001	.497
Firm age	-0.018	.012	.122	-0.018	.004	.000	0.006	.003	.038
Firm size	-1.303	.086	.000	-0.484	.027	.000	-0.122	.020	.000
Board size	-0.026	.028	.357	-0.024	.008	.002	0.006	.008	.484
Property rights	0.183	.175	.295	0.058	.053	.272	-0.060	.026	.019
Constant	32.910	1.795	.000	13.016	.566	.000	2.554	.433	.000
Obs	25215			25215			25215		
R^2	0.380			0.416			0.411		
F	412.04			383.27			68.39		
p-value	.000			.000			.000		

The regression results reveal that ESG performance has a negative and significant effect on both the P/B Ratio ($\beta = -0.015$, $p < .001$) and Tobin's Q ($\beta = -0.003$, $p < .05$), while its influence on EVA is insignificant. These findings challenge the dominant narrative that ESG performance consistently enhances firm value and align with studies suggesting that ESG commitments may impose financial burdens under certain conditions.

The negative relationship between ESG and both P/B Ratio and Tobin's Q echoes prior research indicating that ESG investments can reduce short-term market performance, especially when firms face resource constraints or operate in environments with weak regulatory incentives for sustainability (Yori & Rahmawati, 2025; Wang et al., 2024). Wang et al. (2024) similarly found that while ESG enhances book value, it diminishes market-based performance indicators such as Tobin's Q. This pattern may reflect investor concerns about ESG-related costs, such as increased compliance expenses, resource misallocation, or delayed returns on sustainability investments (Buallay, 2019; Zhou, 2022).

The non-significant effect of ESG on EVA aligns with studies that report no meaningful relationship between ESG performance and firm value in certain contexts (Angir & Weli, 2024; Atan et al., 2018). This result suggests that the value-enhancing effects of ESG may

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require longer time horizons or stronger market mechanisms to manifest. For instance, Almeyda and Darmansyah (2019) found no clear link between ESG scores and stock prices in emerging markets, suggesting that investor sentiment and information asymmetry may limit the immediate financial gains from ESG adoption.

Control variables further highlight firm-specific dynamics. Firm size exhibits a significant negative effect across all three dependent variables, suggesting that larger firms may face greater ESG compliance costs or inefficiencies when scaling sustainability initiatives. Conversely, firm age demonstrates mixed effects, with a positive influence on EVA but no significant relationship with the P/B Ratio and Tobin's Q. This pattern aligns with research indicating that established firms may leverage accumulated resources and experience to manage ESG-related risks more effectively (Zhou, 2024; Sun et al., 2019).

These findings provide partial support for H1, which posits that ESG performance significantly affects firm value. While ESG demonstrates a negative influence on the P/B Ratio and Tobin's Q, its impact on EVA remains inconclusive. This mixed evidence underscores the complex interplay between ESG initiatives, firm characteristics, and market dynamics. As previous studies suggest, the financial outcomes of ESG performance are often context-dependent, influenced by factors such as industry maturity, investor awareness, and regulatory frameworks (Syarkani et al., 2024; Xaviera et al., 2024). Thus, firms seeking to enhance value through ESG initiatives should adopt tailored strategies that align with their operational environment and stakeholder expectations.

4.2. Moderating Effect of Financial Constraints on ESG Performance and Firm Value Relationship

To further explore the dynamics between ESG performance and firm value, this study examines the potential moderating role of financial constraints. Given that firms with limited financial resources may struggle to allocate sufficient capital toward ESG initiatives, understanding this moderating effect is crucial for identifying conditions under which ESG efforts enhance or diminish the firm value. The following section presents the analysis and findings related to this moderating effect.

Table 6 offers valuable insights into the moderating role of financial constraints in the relationship between ESG performance and firm value. The findings indicate that ESG performance does not consistently enhance firm value across all metrics. Specifically, ESG performance shows an insignificant effect on the P/B ratio and EVA, while demonstrating a significant negative effect on Tobin's Q ($\beta = -0.057$, $p < .05$). This suggests that ESG initiatives may not always translate into immediate financial gains and, in some cases, could signal resource diversion that concerns investors. The negative effect on Tobin's Q aligns with previous research indicating that ESG efforts can sometimes strain financial resources, particularly in firms already facing capital constraints (Yori & Rahmawati, 2025; Wang et al., 2024).

The results further reveal that the SA Index, representing financial constraints, has a strong positive effect on both the P/B ratio ($\beta = 7.045$, $p < .001$) and Tobin's Q ($\beta = 4.513$, $p < .001$), while its effect on EVA is marginally significant ($p < .10$). This finding suggests that firms experiencing financial constraints may adopt alternative strategies—such as improved governance practices or strategic ESG positioning—to attract investors and improve market valuation. These results are consistent with prior

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research that emphasizes the role of financial constraints in shaping firm strategies (Ng et al., 2024; Miranda-García & Segovia-Vargas, 2024).

Table 6: FEM Regression Results for the Impact of ESG Performance on Firm Value with Financial Constraints as a Moderator

Predictors	**P/B**			**Tobin's Q**			**EVA**		
	β	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**
$Value_{t-1}$	0.295	.014	.000	0.272	.011	.000	0.452	.025	.000
ESG	-0.036	.048	.454	-0.057	.018	.002	0.028	.020	.160
SA Index	7.045	1.224	.000	4.513	.441	.000	-0.696	.368	.059
ESG x SA	-0.005	.012	.675	-0.014	.005	.003	0.007	.005	.162
Firm age	0.232	.028	.000	0.117	.009	.000	-0.003	.011	.779
Firm size	-1.380	.085	.000	-0.523	.025	.000	-0.119	.020	.000
Board size	-0.029	.028	.300	-0.027	.008	.001	0.006	.008	.467
Property rights	0.265	.175	.130	0.105	.050	.037	-0.064	.025	.012
Constant	57.204	5.097	.000	28.834	1.807	.000	-0.035	1.322	.979
Obs	25215			25215			25215		
R^2	0.400			0.421			0.403		
F	349.89			347.55			60.04		
p-value	.000			.000			.000		

Importantly, the interaction term (ESG × SA Index) reveals a significant negative effect on Tobin's Q ($\beta = -0.014$, $p < .05$), confirming that financial constraints weaken the positive impact of ESG performance on market valuation. This finding aligns with research indicating that firms under financial pressure may struggle to fully capitalize on their ESG investments, particularly in enhancing market perception (Ding et al., 2024; Chen et al., 2024). However, the interaction term is insignificant for both the P/B ratio and EVA, suggesting that financial constraints may not universally undermine ESG's influence on firm value.

These results provide partial confirmation for the study's hypothesis (H2), which proposed that financial constraints moderate the ESG-firm value relationship. While the moderating effect is evident for Tobin's Q, no significant interaction effect was found for the P/B ratio or EVA. This outcome suggests that financial constraints are more likely to affect market-based performance indicators rather than accounting-based measures of long-term value creation. Overall, these findings highlight the need for firms with limited financial resources to strategically allocate capital toward ESG initiatives that deliver measurable value, as the benefits of ESG practices may be diminished if firms lack the financial capacity to sustain their commitments.

4.3. The Second-Order Moderating Role of CEO Duality in Financially Constrained Firms

ESG performance can enhance firm value, yet financial constraints may hinder this relationship. Recent findings indicate that ESG's impact on firm value weakens under financial pressure. This study asserts that CEO duality may further complicate this dynamic, potentially amplifying or mitigating the effect of financial constraints on ESG-driven outcomes. Grounded in Stakeholder Theory and Upper Echelon Theory, this study explores CEO duality's second-order moderating role in this nexus.

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The results presented in Table 7 offer insights into the second-order moderating effect of CEO duality in financially constrained firms, directly addressing H3. The interaction term between ESG, the SA Index, and CEO duality (ESG x SA x CEO) was found to be statistically insignificant across all three measures of firm value — P/B ratio (β = -0.000, p = .880), Tobin's Q (β = 0.000, p = .815), and EVA (β = 0.000, p = .506). These results indicate that CEO duality does not significantly alter the moderating effect of financial constraints (measured through the SA Index) on the ESG–firm value relationship. Consequently, Hypothesis 3 is not supported.

Table 7: FEM Regression Results for the Second-Order Moderating Role of CEO Duality in Financially Constrained Firms

Predictors	**P/B**			**Tobin's Q**			**EVA**		
	β	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**	**β**	**R.S.E.**	**p**
$Value_{t-1}$	0.294	.014	.000	0.271	.011	.000	0.452	.025	.000
ESG	-0.039	.048	.420	-0.057	.018	.002	0.028	.020	.157
SA Index	7.335	1.230	.000	4.680	.443	.000	-0739	.369	.046
ESG x SA	-0.006	.012	.638	-0.014	.005	.002	0.007	.005	.160
CEO	-2.935	1.048	.005	-1.758	.412	.000	0.406	.265	.125
CEO x SA	-0.682	.284	.016	-0.436	.108	.000	0.084	.074	.256
ESG x SA x CEO	-0.000	.002	.880	0.000	.001	.815	0.000	.000	.506
Firm age	0.235	.028	.000	0.118	.009	.000	-0.003	.011	.758
Firm size	-1.388	.085	.000	-0.528	.025	.000	-0.118	.020	.000
Board size	-0.033	.028	.244	-0.028	.008	.000	0.006	.008	.480
Property rights	0.226	.173	.191	0.087	.050	.078	-0.062	.026	.015
Constant	58.608	5.145	.000	29.617	1.820	.000	-0.244	1.336	.855
Obs	25215			25215			0.403		
R^2	0.399			0.419			44.25		
F	257.56			257.04			.000		
p-value	.000			.000			0.403		

This finding aligns with Ananzeh (2024), who identified CEO duality as a factor that weakens governance mechanisms, such as audit committee independence, reducing its ability to mitigate equity costs. Although CEO duality has been shown to undermine governance effectiveness and firm performance in some contexts (Ali et al., 2022; Shelih & Wang, 2023), the current study suggests that in Chinese A-share listed companies, this governance structure does not significantly modify the interaction between financial constraints and ESG performance. The result contrasts with Velte (2019), who observed a positive influence of CEO duality on ESG's financial impact in German firms, suggesting that CEO influence may vary across economic and regulatory environments.

The absence of a significant second-order moderating effect may reflect the unique corporate landscape in China, where state influence, regulatory frameworks, and cultural norms may mitigate the negative effects of CEO duality. Furthermore, as Liu and Xu (2024) emphasized, Chinese firms operating in heavily polluting industries face stricter environmental regulations, which may constrain the ability of powerful CEOs to override sustainability-focused strategies. This regulatory pressure could explain why

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CEO duality does not significantly impact the ESG–firm value relationship under financial constraints.

Overall, these findings reinforce the complexities surrounding leadership structures and sustainability strategies. While previous research highlights the potential risks of CEO duality in limiting board independence and strategic oversight (Ali et al., 2022; Ananzeh, 2024), the current results suggest that in the presence of financial constraints, CEO duality's influence on ESG performance and firm value is not pronounced within Chinese-listed firms. This underscores the need for firms to adopt robust governance mechanisms and align sustainability efforts with their financial capabilities to enhance long-term value creation.

5. Conclusion

This study investigates the impact of ESG performance on firm value, with particular emphasis on the moderating roles of financial constraints and CEO duality. It employed data from A-share-listed Chinese firms from 2014 to 2023 using a comprehensive and systematic approach to ensure data reliability, appropriate variable measurement, and robust statistical analysis. To address econometric concerns, the FEM with robust standard errors was applied following the Hausman test, accounting for the presence of autocorrelation and heteroskedasticity.

The findings reveal that ESG performance exerts a negative and significant effect on both the P/B ratio and Tobin's Q, while its influence on EVA is insignificant. These results challenge the notion that ESG initiatives consistently enhance firm value, suggesting that such efforts may impose short-term financial burdens or signal resource misallocation in certain contexts. Financial constraints were found to weaken the positive effects of ESG on Tobin's Q, underscoring the challenges firms face in translating ESG investments into immediate financial gains when capital resources are limited. However, the anticipated second-order moderating role of CEO duality was insignificant across all measures of firm value, indicating that CEO duality does not substantially alter the influence of financial constraints on ESG-driven outcomes.

5.1. Implications

This study contributes to the existing literature by advancing our understanding of the ESG-firm value nexus through the integration of Stakeholder Theory, Resource Dependence Theory, and Upper Echelon Theory. The results emphasize that ESG initiatives may not uniformly improve firm value, particularly in resource-constrained environments. The negative relationship between ESG performance and market-based indicators like Tobin's Q suggests that short-term financial pressures may override the perceived long-term benefits of ESG investments. Moreover, the study underscores the nuanced role of financial constraints, revealing that firms with limited financial flexibility may struggle to sustain ESG commitments that yield positive outcomes. The insignificance of CEO duality's second-order moderation highlights the potential contextual nature of leadership dynamics in influencing ESG outcomes, especially within Chinese-listed firms where state influence and regulatory pressures may mitigate CEO dominance.

From a managerial perspective, firms should adopt strategic ESG initiatives that align with their financial capacity to ensure value creation. Companies facing financial

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constraints should prioritize ESG investments that offer tangible, short-term gains or align with investor preferences to mitigate concerns about resource misallocation. Furthermore, firms should integrate ESG objectives into their core strategic planning processes, ensuring that sustainability initiatives are aligned with both financial priorities and operational realities. For firms operating in heavily regulated markets like China, robust governance frameworks are essential to ensure ESG initiatives align with both shareholder expectations and regulatory requirements.

To effectively manage ESG integration alongside financial constraints and governance complexities, firms should tailor their ESG strategies to their operational environment and financial capacity, ensuring sustainability investments are both strategic and manageable. Companies with financial constraints should implement rigorous budgetary controls and prioritize ESG projects with clear, measurable outcomes to maximize returns on investment. Additionally, firms should actively engage with investors, regulators, and other stakeholders to communicate the long-term benefits of ESG commitments, alleviating concerns about short-term financial risks. Policymakers should consider introducing targeted subsidies, tax incentives, or grants to support financially constrained firms in implementing ESG initiatives. Lastly, companies should focus on reinforcing independent governance mechanisms to ensure accountability and oversight in ESG decision-making processes, particularly in firms with CEO duality structures. By adopting these strategies, firms can better manage the complexities of ESG integration, financial constraints, and leadership dynamics to achieve sustainable growth and enhance firm value.

5.2. Limitations and Future Research Agenda

Despite its contributions, this study has certain limitations that future research may address. First, the study's reliance on secondary data may limit the precision and contextual understanding of ESG practices within firms. Incorporating qualitative insights or firm-level interviews could provide a more comprehensive view of ESG strategies and decision-making processes. Second, while the study controls for several firm-level characteristics, other potentially influential factors such as corporate culture, innovation strategies, or regional economic conditions were not explicitly examined. Future research could explore these variables to better understand their role in moderating ESG outcomes. Third, the study's focus on Chinese-listed firms may limit the generalizability of the findings to other institutional contexts. Future studies could conduct comparative analyses across different countries or regions to assess the broader applicability of the results. Lastly, this study emphasizes financial constraints and CEO duality as moderators; future research may extend this framework by investigating additional governance attributes, industry-specific dynamics, or emerging regulatory frameworks that could influence the ESG-firm value relationship. By addressing these gaps, future studies can build a deeper understanding of ESG's strategic impact on firm performance across diverse contexts.

Ethics Approval and Consent to Participate

This study utilized properly obtained secondary data and strictly adhered to all ethical standards concerning research involving human subjects. Informed consent was obtained from all participants, who were assured of their anonymity and the confidentiality of their responses. They were also informed that the study posed

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minimal risk and that participation was entirely voluntary, with the option to withdraw at any time without any negative consequences.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest concerning the research, authorship, or publication of this article.

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