Business Strategy and the Environment

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RESEARCH ARTICLE OPEN ACCESS

The ESG Emissions Paradox: Capability-Contingent Effects of Research and Development and Cost Leadership in Asia

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Received: 13 May 2025 | **Revised:** 14 October 2025 | **Accepted:** 26 October 2025

Keywords: Asia | corporate strategy | cost leadership | ESG | greenhouse gas emissions | innovation

ABSTRACT

This study investigates the impact of greenhouse gas (GHG) emissions, research and development (R&D) spending, and cost leadership strategies (CLSs) on the environmental, social, and governance (ESG) performance of Asian firms from 2015 to 2023. Multiple econometric methods, including ordinary least squares (OLS), fixed effects, the generalized method of moments (GMM), and quantile regression, are employed to test the hypotheses. The study's findings indicate a positive association between GHG emissions intensity and ESG performance, suggesting that higher emitting firms tend to bolster their ESG ratings chiefly through enhanced transparency and governance practices rather than through emissions reductions. R&D intensity and CLS also demonstrate positive associations with ESG performance, with powerful effects among firms with initially lower capabilities. Quantile regression results indicate that these relationships vary across performance levels; top-performing firms achieve a deeper level of sustainability integration, whereas lower performing firms rely more heavily on disclosure strategies. These results contribute to a deeper understanding of corporate sustainability in emerging markets and offer practical implications for policymakers, investors, and managers.

1 | Introduction

Sustainability has become a strategic imperative for firms, as environmental, social, and governance (ESG) performance is increasingly viewed by stakeholders as an indicator of corporate responsibility and resilience. In this evolving landscape, companies are under growing pressure to align their operations with environmental objectives, meet stakeholder expectations, and respond to emerging regulatory demands (Berrone et al. 2017; Dahlmann et al. 2019; Carungu et al. 2025). ESG ratings, which aggregate firm performance across ESG pillars, now influence investor decisions, market valuations, and corporate legitimacy (Dyck et al. 2019; Chasiotis et al. 2024). However, how firms operationalize ESG strategies, particularly in emissions-intensive contexts, remains underexplored.

A growing body of research has begun to question the presumed alignment between firm-level environmental impact and ESG performance metrics (e.g., Al-Shaer et al. 2024; Bams and van der Kroft 2022; Haque and Ntim 2020; Tan et al. 2024; Uyar et al. 2022; Van Binsbergen and Brøgger 2022), revealing a complex interplay between corporate emissions, strategic responses, and reputational dynamics. Rather than penalizing high-emitting firms, ESG ratings may absurdly reward them when they engage in visible sustainability initiatives, suggesting a compensatory mechanism driven by stakeholder expectations and legitimacy concerns (Matsumura et al. 2014). In this view, firms with larger carbon footprints may be more motivated to improve transparency, engage in symbolic ESG actions, or adopt sustainability disclosures to mitigate reputational risks. [1] At the same time, the resource-based view (RBV) emphasizes the role of internal capabilities, such as innovation and cost efficiency, as pathways through which firms integrate sustainability into their core operations. [2]

Against this backdrop, the study examines ESG performance through three interrelated strategic dimensions: greenhouse gas (GHG) emissions intensity, research and development (R&D) intensity (RDI), and a cost leadership strategy (CLS). Specifically, the primary objective of this study is to examine the relationship between GHG emissions intensity and ESG performance, challenging the conventional assumption that higher emissions are uniformly associated with weaker ESG outcomes. In this vein, it explores whether higher emitting firms engage more actively in ESG-related initiatives, possibly as a strategic response to reputational pressures. In addition, the paper investigates the role of RDI and CLS in shaping ESG performance.

To accomplish the research objective, this study adopts a rigorous methodological framework. Using a dataset of Asian firms for 2015–2023, it employs several econometric techniques—including OLS with year fixed effects, fixed-effects models with year and country fixed effects, and two-step GMM—to test the research hypotheses. In addition, the study applies method-of-moments quantile regression (MMQR) to provide nuanced insights into these relationships across ESG performance quantiles. This methodological rigor strengthens the reliability and validity of the findings. By addressing potential endogeneity and unobserved heterogeneity, the analysis provides robust evidence on the factors driving ESG performance in Asian firms. The region's dual character justifies the focus on publicly listed firms in Asia: economically dynamic yet environmentally burdened, accounting for more than half of GHG emissions. Given the institutional diversity, regulatory fragmentation, and varying resource constraints across Asian economies, this context offers a fertile empirical setting for examining how corporate strategies intersect with ESG outcomes.

This study provides several contributions to the literature on ESG performance and corporate strategy.

First, it contradicts conventional assumptions by highlighting the positive relationship between GHG emissions and ESG performance. This finding underscores the complexity of sustainability dynamics and the need for a nuanced understanding of how firms navigate environmental challenges. ESG ratings aim to capture a firm's ESG practices, with the environmental component directly tied to emissions, such as carbon dioxide and other GHGs. Emissions are a measurable and impactful factor that can significantly shape ESG outcomes, particularly in the context of stakeholder expectations, market dynamics, and regulatory pressures (Treepongkaruna et al. 2024). As a result, these firms may adopt stronger ESG practices, such as enhancing transparency, investing in renewable energy, or engaging in carbon offset programs, to legitimize their operations and maintain stakeholder trust (Cohen et al. 2020; Haque and Ntim 2020).

Second, the study emphasizes the critical role of innovation in driving ESG performance, offering actionable insights for firms seeking to enhance their sustainability practices. Studies have shown that R&D investments not only enable firms to develop eco-friendly technologies but also help reduce emissions through process optimization and product innovation, thereby aligning sustainability goals with improved ESG metrics (Fu et al. 2020; Padgett and Galan 2010). Firms' efficiency and R&D capabilities are better equipped to develop eco-friendly products, improve energy efficiency, and optimize resource use. Moreover, R&D investments signal a forward-looking approach to sustainability, which resonates with stakeholders seeking long-term value creation (Tan et al. 2024). In the Asian context, the importance of RDI is particularly pronounced. Rapid technological advancements and the region's growing emphasis on green innovation provide fertile ground for leveraging R&D to drive ESG performance.

Third, the study emphasizes the critical role of cost leadership in driving ESG performance, offering actionable insights for firms seeking to enhance their sustainability practices. Firms pursuing cost leadership often focus on optimizing operational efficiency, reducing waste, and minimizing costs (Al-Shaer et al. 2024; Uyar et al. 2022). These practices inherently align with key ESG principles, such as resource conservation and environmental stewardship. The significant positive impact of cost leadership on ESG performance observed in this study suggests that financial prudence and sustainability are not mutually exclusive but can be mutually reinforcing. In Asia, where cost-sensitive markets dominate, integrating CLSs with ESG objectives is particularly relevant.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature, and Section 3 outlines the theoretical framework and development of hypotheses. Section 4 explains the research methodology. Section 5 presents and discusses the study's results. Finally, Section 6 provides concluding remarks, including theoretical and practical implications, and the study's limitations with potential future research avenues.

2 | Literature Review

Recent literature reveals a complex relationship between corporate emissions, strategic behavior, and ESG outcomes. Specifically, empirical evidence shows that the association between a firm's carbon footprint and its ESG rating is nuanced rather than uniformly negative. Large-sample studies demonstrate that "brown" firms often earn comparatively high ESG scores after expanding sustainability disclosures and linking executive pay to environmental targets, thereby dampening market penalties for high emissions (Haque and Ntim 2020; Matsumura et al. 2014; Raghunandan and Rajgopal 2022; Treepongkaruna et al. 2024). However, higher ratings do not always correspond to lower future emissions, suggesting that disclosure can operate more symbolically than substantively and fueling concerns about greenwashing (Van Binsbergen and Brøgger 2022; Wedari et al. 2021; Zhang 2023). Stakeholder scrutiny reinforces these patterns: Survey evidence and carbon-registry data outline that external pressure from investors, regulators, and customers accelerates carbon reporting and broader ESG adoption, especially where carbon taxes or mandatory disclosure rules are in force (Bolton and Kacperczyk 2021; Liesen et al. 2015; Luo et al. 2012).

Firm-level capabilities further shape ESG outcomes. Robust cross-industry findings reveal that greater RDI is linked to lower emission intensity and higher environmental scores, as innovation drives cleaner processes, eco-product development, and signals long-term strategic commitment (Fu et al. 2020; Li and Xu 2024; Padgett and Galan 2010). Cost-leadership strategies provide a complementary pathway. Particularly, firms that emphasize waste minimization, energy efficiency, and lean capital allocation consistently show stronger ESG performance without sacrificing profitability (Al-Shaer et al. 2024; Uyar et al. 2022). Taken together, the literature identifies three robust regularities: High emitters can secure strong ESG ratings through heightened transparency and engagement; sustained R&D investment yields tangible environmental gains and reputational benefits; and cost-efficient operations align financial prudence with credible sustainability performance.

So, the study's central contribution is to demonstrate a positive association between GHG emissions intensity and ESG performance—a finding that, although counterintuitive, reflects how higher emitting firms deploy ESG initiatives and disclosures to manage legitimacy and stakeholder expectations. By integrating new institutional theory (NIT) with the RBV, this study intends to show how external pressures and firm capabilities jointly shape ESG outcomes, underscoring the importance of both symbolic and substantive sustainability actions.

3 | Theoretical Background and Hypotheses Development

NIT explains how firms conform to external expectations through three institutional pressures: coercive (regulatory mandates such as carbon taxes and disclosure rules), normative (demands from investors, regulators, and customers), and mimetic (imitation of industry leaders to secure legitimacy) (DiMaggio and Powell 1983; Meyer and Rowan 1977; Suddaby et al. 2013; Nicolo et al. 2025). For high-emitting companies, stringent coercive and normative pressures intensify incentives to adopt ESG practices. These responses range from symbolic measures, such as expanded sustainability reporting, to substantive initiatives that directly reduce emissions. The persistent tension between symbolic and substantive action highlights the complexity of corporate sustainability strategy and the risk of greenwashing (Bui et al. 2020; Treepongkaruna et al. 2024).

The RBV complements NIT by emphasizing internal capabilities as drivers of credible ESG performance (Barney 1991). Two capabilities are especially salient: (i) R&D intensity, which fosters eco-innovation and operational efficiency; and (ii) cost leadership orientation, which embeds resource conservation and waste reduction into core processes. This study highlights the transformative impact of RDI and CLS on ESG performance. RDI drives innovation, enabling firms to adopt sustainable practices, improve efficiency, and enhance ESG outcomes. Simultaneously, CLS fosters operational efficiency and cost minimization, allowing firms to integrate ESG goals into their strategies without compromising financial performance. High-GHG firms often utilize their resources, such as R&D investments, to develop innovative solutions that improve their ESG performance.

Together, NIT and RBV provide a coherent framework for analyzing why and how emission-intensive firms adopt ESG strategies, distinguishing legitimacy-seeking disclosures from capability-driven, performance-based sustainability.

NIT suggests that firms facing intense institutional pressures, particularly high-emitting companies, are motivated to adopt ESG practices to maintain legitimacy and mitigate stakeholder scrutiny (Nicolo' and Cervilla-Bellido 2025; Nicolo et al. 2025). Accordingly, empirical evidence demonstrates that "brown" firms can achieve comparatively high ESG ratings by expanding sustainability disclosures, linking executive compensation to environmental targets, and engaging proactively with stakeholders (Matsumura et al. 2014; Raghunandan and Rajgopal 2022). This phenomenon reflects firms' strategic responses to coercive pressures from regulators and normative pressures from investors and customers. So, although concerns about greenwashing persist, the institutional imperative for high emitters to demonstrate ESG commitment—through enhanced transparency and governance mechanisms—is expected to engender a positive association between emissions levels and ESG scores.

Therefore, based on theoretical arguments and empirical evidence, the following hypothesis is posited:

Hypothesis 1. *There is a positive relationship between greenhouse gas emissions (GHG) and ESG performance.*

The RBV emphasizes that firm-specific capabilities drive sustainable competitive advantage and credible ESG performance (Wang et al. 2025). From this standpoint, RDI represents a critical organizational capability that enables eco-innovation, process improvements, and the development of environmentally friendly products and services (Kabongo 2019). Cross-industry empirical findings consistently show that firms with greater RDI achieve lower emission intensity and higher environmental scores (Fu et al. 2020; Li and Xu 2024). Accordingly, R&D investments signal long-term strategic commitment to sustainability, foster technological solutions that address environmental challenges, and create valuable, rare, and difficult-to-imitate resources that enhance ESG outcomes.

Therefore, based on theoretical arguments and empirical evidence, the following hypothesis is posited:

Hypothesis 2. *There is a positive relationship between research and development intensity (RDI) and ESG performance.*

CLS provides a complementary pathway to ESG excellence by embedding resource conservation and operational efficiency into core business processes. From an RBV perspective, firms pursuing cost leadership develop capabilities in waste minimization, energy efficiency, and lean capital allocation that simultaneously reduce costs and environmental impact (Al-Shaer et al. 2024; Uyar et al. 2022). This strategic orientation creates a natural alignment between financial prudence and environmental stewardship, enabling firms to achieve stronger ESG performance without sacrificing profitability (Hussain et al. 2018). The systematic focus on operational efficiency inherent in CLSs directly supports environmental goals while building organizational capabilities that enhance overall sustainability performance.

Therefore, based on theoretical arguments and empirical evidence, the following hypothesis is posited:

Hypothesis 3. *There is a positive relationship between cost leadership strategy (CLS) and ESG performance.*

Figure 1 presents the study's conceptual framework.

4 | Research Methodology

4.1 | Sampling Process

This study adopts a quantitative research design to examine the relationship between GHG emissions intensity, RDI, CLS, and ESG performance among publicly listed firms in Asia over the period 2015–2023. The analysis relies primarily on firm-level data from the London Stock Exchange Group (LSEG, formerly Refinitiv) database, supplemented with financial variables from Compustat.

The LSEG database is one of the most comprehensive global financial data sources, covering approximately 70% of global market capitalization and providing standardized, comparable ESG metrics for thousands of listed firms (LSEG 2024). LSEG's ESG scores are widely used in academic literature and are considered a reliable approximation of a company's performance in the ESG dimensions (Kim et al. 2021). ESG scores are derived from over 630 data points across company CSR reports, sustainability disclosures, annual reports, proxy statements, and websites. These are condensed into more than 186 key performance indicators, grouped under 10 categories and further consolidated into the three ESG pillars. LSEG employs a z-score normalization methodology (ranging from 0 to 100),[3] which enables cross-industry comparability and minimizes biases related to firm size and disclosure practices. Environmental and social scores are benchmarked against LSEG Business Classifications, whereas governance scores are compared at the country level (LSEG 2023).

LSEG was selected as a primary source because of its broad geographic coverage, detailed emissions data (including Scope 1, 2, and 3 emissions), and rich ESG scoring framework. The initial sample comprised all Asian firms available in the LSEG ESG database. However, firms with missing data on key variables, particularly ESG scores and GHG emissions, were excluded. Financial firms were also removed to avoid bias stemming from their distinct capital structures and regulatory environments. The final sample includes 3852 unique firms from 20 Asian countries, representing a total of 20,177 firm-year observations over the sample period. The firm-level dataset was matched with Compustat using ISIN and Ticker codes to retrieve financial variables, including firm size, profitability, and capital structure. Table 1 reports the country-wise distribution of the sample, with China contributing the largest number of observations, followed by Japan and India.

4.2 | Study Variables

4.2.1 | Dependent Variable

The dependent variable of this study is ESG performance, measured using the ESG combined score collected from the LSEG database (LSEG 2024). This database covers approximately 70% of the global company market capitalizations. The ESG scores provided by LSEG transparently and objectively measure an organization's relative ESG performance, commitment, and effectiveness based on more than 500 comparable ESG metrics (Asimakopoulos et al. 2023; Bagh et al. 2024).

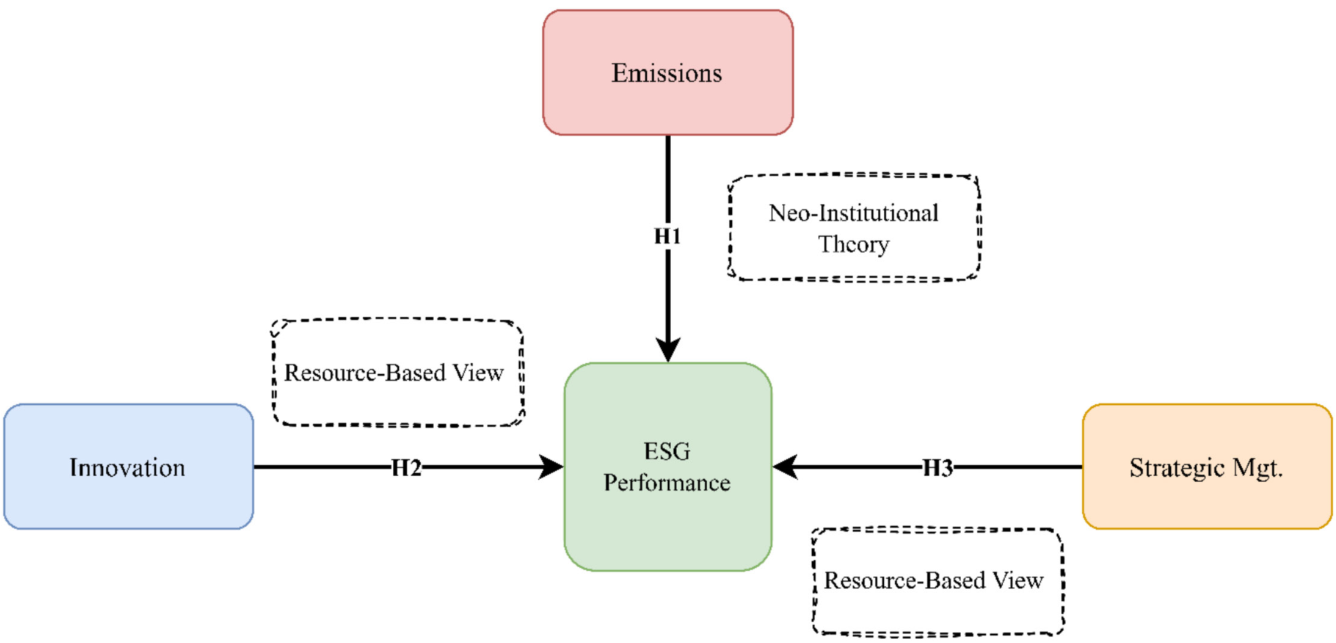

FIGURE 1 | Conceptual framework of the study.

TABLE 1 | Sample distribution across countries.

ISO 3 code	Country name	Frequency	Percent
CHN	China	5826	28.87%
JPN	Japan	3433	17.01%
IND	India	2154	10.68%
TWN	Taiwan	1321	6.55%
HKG	Hong Kong	1242	6.16%
MYS	Malaysia	1209	5.99%
KOR	South Korea	1166	5.78%
THA	Thailand	806	3.99%
SGP	Singapore	561	2.78%
TUR	Türkiye	535	2.65%
IDN	Indonesia	433	2.15%
SAU	Saudi Arabia	304	1.51%
ISR	Israel	285	1.41%
PHL	Philippines	241	1.19%
QAT	Qatar	216	1.07%
ARE	United Arab Emirates	188	0.93%
KWT	Kuwait	94	0.47%
VNM	Viet Nam	69	0.34%
OMN	Oman	52	0.26%
PAK	Pakistan	42	0.21%
20	Total	20,177	100

Note: The table presents the sample distribution across countries for study variables. The sample spans 2015–2023 and includes 3852 listed firms from 20 Asian countries.

4.2.2 | Independent Variables

The independent variables of this study include GHG emissions intensity, RDI, and CLS. Following Ardia et al. (2022) and Oyewo et al. (2024), GHG emissions intensity was measured using data on Scope 1, 2, and 3 emissions from the LSEG database.[4] "Scope 1 emissions are direct emissions from owned or controlled sources by the reporting company. For example, direct emissions from a coal-fired power plant. Scope 2 emissions are indirect emissions from the consumption of electricity, heat, steam, and cooling. For example, indirect emissions from the electricity consumption of company-owned computer servers. Scope 3 emissions are indirect emissions from upstream and downstream activities in the company's value chain or its products life cycle" (LSEG 2024). GHG emissions intensity is calculated as the total estimated Scope 1, 2, and 3 GHG emissions (in tons) divided by net sales or revenues (in millions of US dollars).

RDI is calculated by dividing total R&D expenditure by total sales (Fu et al. 2020; Nunes et al. 2012; Padgett and Galan 2010). CLS is calculated as the negative sum of capital intensity, cost efficiency, and capital expenditure, where capital intensity is total assets over total sales, cost efficiency is the cost of goods sold over total sales, and capital expenditure is capital expenditures over total sales (Al-Shaer et al. 2024; Uyar et al. 2022). Multiplying by −1 reverses the sign of values, making higher ratios indicative of a stronger CLS orientation.

4.2.3 | Control Variables

To mitigate bias in results and enhance the consistency of the analysis, some control variables have been included (Berkman et al. 2024; Bolton and Kacperczyk 2021; Bui et al. 2020; Treepongkaruna et al. 2024). These include leverage (LEV), calculated as long-term debt scaled by the market value of common equity; firm size (SIZE), measured as the natural logarithm of total assets; profitability, measured using return on assets (ROA); cash flow volatility (CFV), measured as the 5-year rolling standard deviation of operating cash flows divided by total assets; board size (BSZ), measured by the number of directors sitting on the board; and country development level, proxied by the natural logarithm of GDP per capita (current USD).

4.3 | Empirical Models

This study employs a multimethod econometric approach to examine the impact of GHG emission intensity, RDI, and CLS on ESG performance.

4.3.1 | Ordinary Least Squares (OLS)

The baseline model estimates the effects of GHG emissions, RDI, and CLS on ESG performance using OLS, controlling for firm- and industry-level factors. The baseline specification is given in Equation (1):

$$\begin{aligned} ESG_{it} = \alpha + \beta_1 GHG_{it} + \beta_2 RDI_{it} + \beta_3 CLS_{it} \\ + \beta_4 Controls_{it} + \gamma_t + \epsilon_{it} \end{aligned} \quad (1)$$

Here, ESG_{it} represents the ESG performance of firm i in year t, whereas GHG_{it}, RDI_{it}, and CLS_{it} denote the key independent variables. Control variables include LEV, SIZE, ROA, CFV, BSZ, and GDP per capita. Year fixed effects γ_t are included to control for macroeconomic shocks.

4.3.2 | Fixed Effects Models

To account for unobserved heterogeneity across firms and countries, the study estimates a fixed-effects model. This approach controls for time-invariant characteristics at the firm and country levels. Following Bolton and Kacperczyk (2023), the study adopts a characteristic-based specification.

$$\begin{aligned} ESG_{it} = \alpha + \beta_1 GHG_{it} + \beta_2 RDI_{it} + \beta_3 CLS_{it} \\ + \beta_4 Controls_{it} + \gamma_t + \delta_c + \epsilon_{it} \end{aligned} \quad (2)$$

where δ_c captures country- or industry-specific effects. This model improves the precision of empirical estimates by absorbing unobserved contextual factors.

4.3.3 | Quantile Regression

To explore heterogeneity in ESG determinants across the ESG performance distribution, the study employs MMQR as developed by Machado and Santos (2019). MMQR is well suited to panel data, as it accounts for fixed effects and allows the impact of explanatory variables to vary across different quantiles of the dependent variable. This approach captures distributional asymmetries and shows how covariates influence not only the mean but the entire conditional distribution of ESG scores (Güney 2024).

4.3.4 | Robustness Checks

To further verify the stability of the findings, several robustness checks are conducted. First, firm-level GHG intensity is replaced with an industry-average GHG measure. Second, firms from environmentally sensitive industries are excluded, and observations from the COVID-19 period are dropped. Third, propensity score matching (PSM) is implemented to attenuate selection bias. Finally, potential endogeneity is addressed by applying a two-step generalized method of moments (GMM) estimator, ensuring that the estimates are consistent and unbiased.

5 | Results and Discussion

5.1 | Descriptive Statistics and Correlations

Table 2 presents the descriptive statistics for dependent and independent variables. The average ESG performance score is 0.367, with a standard deviation of 0.318, indicating moderate performance across firms but with notable variation. The median ESG score is 0.322, and the top 25% of firms achieve scores above 0.663, highlighting disparities in ESG efforts. GHG emissions intensity averages 6.094 with a standard deviation of 1.927. RDI has a low mean of 0.016 and a median close to zero (0.001), signaling limited investment in innovation for many firms; the standard deviation of 0.036 points to substantial cross-firm heterogeneity in R&D spending. CLS has a mean of −2.700 (median −2.006; SD = 4.615), suggesting wide variability in firms' strategic emphasis on cost efficiency. Higher (i.e., less negative) CLS values denote a stronger orientation toward cost leadership.

LEV averages 0.213 (median 0.191). ROA has a mean of 0.055 and a median of 0.037, whereas SIZE has a mean of 9.514 and a median of 10.602. CFV has a mean of 0.029 and a median of 0.022, indicating relatively stable cash flows for most firms. BSZ averages 9.160 directors (median 9; SD = 3.787), suggesting variability in board size. Finally, GDP per capita (log-transformed) averages 28.653, with a median of 28.841. Collectively, these descriptive statistics underscore marked heterogeneity in firm characteristics, strategic orientations, and external economic environments, providing a solid foundation for analyzing their influence on ESG performance.

Table 3 provides correlations and variance inflation factor (VIF) values, offering an initial view of their interrelationships. Notably, ESG performance is positively correlated with GHG emissions, indicating that higher emission firms tend to have better ESG scores. Weak positive correlations are also observed between ESG performance and RDI, CLS, SIZE, and BSZ, highlighting the importance of innovation, strategic cost management, and governance in driving ESG outcomes. Conversely, ESG performance is negatively associated with CFV. GHG emissions are positively correlated with BSZ, indicating that governance structures may influence emissions disclosures, but are negatively correlated with RDI, suggesting that high-emission firms may deprioritize innovation. The CLS shows weak negative correlations with GHG emissions and RDI, suggesting that cost-efficient firms may devote less attention to innovation and emissions-related initiatives. Importantly, all VIF values are below 2, with a mean of 1.17, confirming the absence of multicollinearity issues and ensuring the reliability of the regression analyses. These correlations align with the study's hypotheses

TABLE 2 | Descriptive statistics.

Variable	*N*	Mean	SD	P25	Median	P75
ESG	20,177	0.367	0.318	0.030	0.322	0.663
GHG	20,177	6.094	1.927	5.358	6.108	7.122
RDI	20,177	0.016	0.036	0.000	0.001	0.019
CLS	20,177	−2.700	4.615	−2.891	−2.006	−1.405
LEV	20,177	0.213	0.179	0.054	0.191	0.331
ROA	20,177	0.055	0.061	0.013	0.037	0.076
SIZE	20,177	9.514	5.017	8.106	10.602	12.927
CFV	20,177	0.029	0.032	0.007	0.022	0.040
BSZ	20,177	9.160	3.787	7.000	9.000	11.00
GDP	20,177	28.653	1.488	26.966	28.841	30.29

Note: The table presents the descriptive statistics of study variables. The sample spans 2015–2023 and includes 3852 listed firms from 20 Asian countries.

TABLE 3 | Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Mean VIF
(1) ESG	1.000										
(2) GHG	0.216***	1.000									
(3) RDI	0.029***	−0.123***	1.000								
(4) CLS	0.023***	−0.022***	−0.078***	1.000							
(5) LEV	0.047***	0.071***	−0.182***	−0.084***	1.000						
(6) ROA	−0.055***	−0.082***	0.096***	0.087***	−0.311***	1.000					
(7) SIZE	0.327***	0.120***	−0.029***	0.046***	0.052***	−0.084***	1.000				
(8) CFV	−0.107***	−0.057***	0.164***	−0.008	−0.144***	0.405***	−0.120***	1.000			
(9) BSZ	0.331***	0.444***	−0.110***	0.001	0.079***	−0.108***	0.180***	−0.144***	1.000		
(10) GDP	0.006	−0.004	0.187***	0.011	−0.090***	−0.007	0.050***	0.054***	0.028***	1.000	
VIF		1.27	1.10	1.02	1.15	1.31	1.05	1.24	1.30	1.05	1.17

Note: Asterisks ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

regarding the complex interplay between emissions, innovation, cost efficiency, and ESG performance.

5.2 | Trends in ESG Performance and GHG Intensity

Figure 2 illustrates variation in average ESG performance scores across Asian countries from 2015 to 2023. Taiwan (0.56) and Hong Kong (0.54) lead, reflecting comparatively strong sustainability practices, whereas Vietnam (0.04) and Pakistan (0.10) lag markedly. Mid-tier performers include China (0.33), India (0.33), and Korea (0.38). This disparity underscores the influence of country-specific factors, such as regulatory regimes and levels of economic development, in shaping ESG outcomes, and highlights opportunities for lower performing countries to emulate regional leaders' best practices.

Figure 3 illustrates the trend in average GHG emissions intensity among the sampled firms over 2015–2023. GHG intensity follows an upward trajectory, rising from 6.13 in 2015 to a peak of 6.47 in 2018. A modest decline ensues, with intensity stabilizing around 6.40 between 2019 and 2021. From 2022 onward, however, a renewed increase is observed, reaching 6.50 by 2023. Overall, despite minor improvements in certain periods, GHG intensity has increased across the sample window, indicating a growing environmental burden associated with industrial activity in the region. This pattern underscores the need for stronger emissions-reduction strategies and enhanced ESG efforts to counteract the trend.

5.3 | Baseline Regression Analysis

Table 4 shows the baseline regression results, pinpointing the relationships between ESG performance and the key explanatory variables GHG, RDI, and CLS.

Across all three models, GHG emission intensity shows a positive, statistically significant relationship with ESG performance. RDI shows a consistently positive and highly significant impact on ESG performance. This underscores the role of innovation as a critical enabler of sustainability. The CLS also demonstrates a positive and significant effect on ESG performance. This suggests that firms focusing on operational efficiency can align their cost-saving measures with ESG principles, such as resource conservation and waste reduction. Figure 4 depicts the coefficients of key explanatory variables, GHG, RDI, and CLS, based on Model 3 included in Table 4.

Among the controls, LEV shows a positive and significant association with ESG performance, and ROA is likewise positive and significant. SIZE is positive and significant across all specifications, whereas CFV is negative and significant. BSZ is positive and significant, and GDP also yields a positive, statistically significant coefficient. The robustness of these results is reinforced by the inclusion of country- and year-fixed effects and by clustering standard errors at the firm level, which mitigate biases from unobserved heterogeneity and serial correlation. Collectively, these findings pave the way for a deeper discussion of how firm-specific and contextual factors shape ESG performance in the subsections that follow.

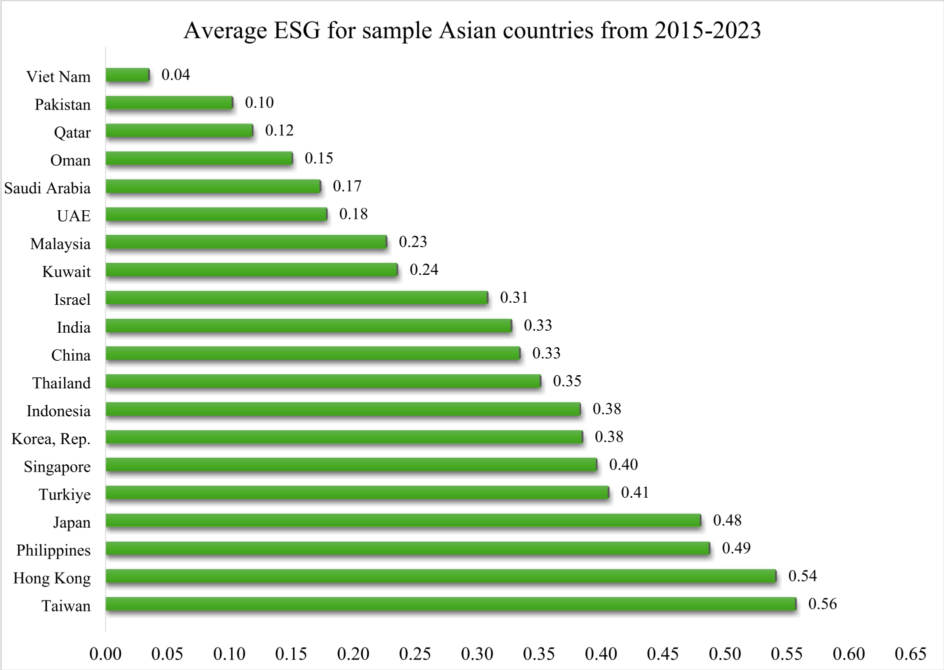

FIGURE 2 | Average ESG for sample Asian countries from 2015 to 2023.

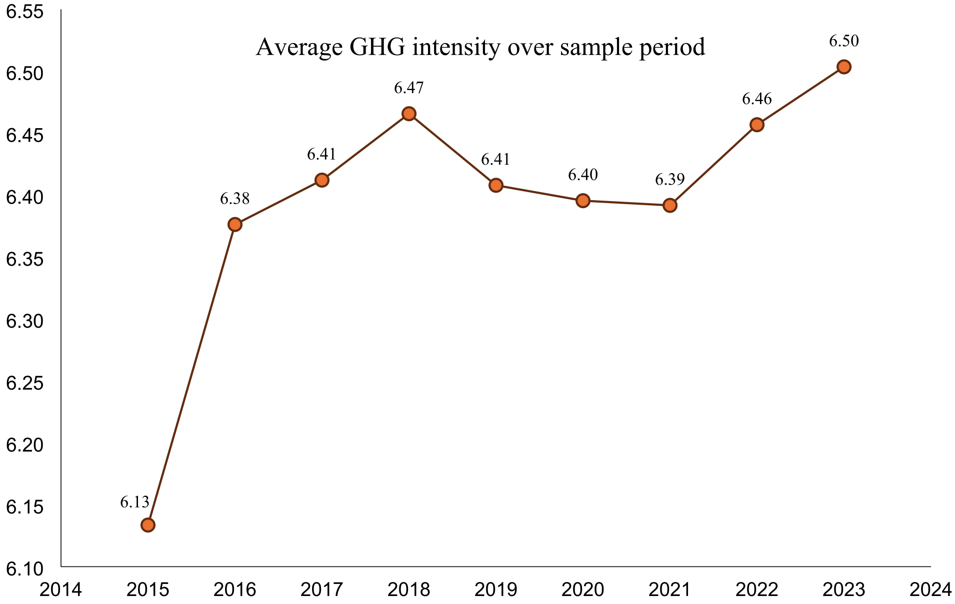

FIGURE 3 | Average GHG intensity 2015–2023.

5.4 | Additional Analyses

Traditional panel quantile models are used to assess nonlinear effects across quantiles, yet entity-specific fixed effects are not accommodated. To address this limitation, MMQR is employed as a robust approach for nonlinear panel settings. Within MMQR, asymmetry in the dependent variable is accommodated, and the entire conditional distribution is permitted to be shaped by individual effects rather than merely shifting the mean. In turn, heterogeneous covariate effects can be identified, making MMQR particularly effective for panel data with potential endogeneity and unobserved individual effects. Accordingly, MMQR is applied to rigorously analyze the nonlinear impacts of the independent variables on ESG performance. Table 5 presents MMQR estimations, highlighting the relationships between ESG performance and its determinants across various points of the ESG distribution. GHG consistently shows a positive and significant impact on ESG performance across all quantiles, with the coefficient increasing from 0.020*** at the 10th (Q10) to 0.035*** at the 95th (Q95). RDI also exhibits a progressively more substantial impact on ESG performance, with coefficients ranging from 0.513*** at Q10 to 0.972*** at Q95. CLS maintains a positive and significant relationship across all quantiles, with coefficients remaining relatively stable. This indicates that the

TABLE 4 | Baseline regression analysis.

	The dependent variable is ESG performance		
	(1)	(2)	(3)
Variables	OLS	FE	FE
GHG	0.026***	0.026***	0.027***
	(0.001)	(0.002)	(0.002)
RDI	0.709***	0.709***	0.631***
	(0.051)	(0.124)	(0.115)
CLS	0.001***	0.001*	0.002***
	(0.000)	(0.001)	(0.001)
LEV	0.034***	0.034*	0.023
	(0.011)	(0.020)	(0.019)
ROA	0.066**	0.066	0.093*
	(0.033)	(0.054)	(0.054)
SIZE	0.020***	0.020***	0.021***
	(0.000)	(0.000)	(0.000)
CFV	−0.148**	−0.148	−0.139
	(0.062)	(0.098)	(0.095)
BSZ	0.016***	0.016***	0.013***
	(0.001)	(0.001)	(0.001)
GDP	−0.005***	−0.005***	0.272***
	(0.000)	(0.000)	(0.029)
Constant	0.181***	−0.017	−7.430***
	(0.012)	(0.019)	(0.769)
Observations	20,177	20,177	20,177
Adj. R^2	0.382	0.382	0.422
Year FE	Yes	Yes	Yes
Country FE			Yes
Cluster-ID			Yes

Note: This table presents the baseline regression analysis results; Model 1 is the baseline. Model 2 adds the year-fixed effects. Model 3 includes both year and country-fixed effects and clusters by firm ID. Below the coefficients, the standard errors are presented in parentheses, and asterisks ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

cost-efficiency benefits of CLS contribute consistently to ESG performance, irrespective of a firm's ESG standing.

The MMQR results provide a nuanced understanding of the heterogeneous impacts of GHG, RDI, and CLS on ESG performance. By examining different points of the ESG distribution, this analysis highlights the varying strengths of these relationships across firms with differing ESG characteristics. These findings further enrich the discussion of ESG performance determinants, offering targeted insights for policymakers, managers, and investors. The consistent significance of GHG, RDI, and CLS further underscores their role in shaping ESG outcomes in Asian firms.

A second additional analysis—outlined in Table 6—is conducted to test the hypotheses on the individual components of ESG performance. It is found that GHG exhibits the strongest positive association with the Environmental score (0.034***), whereas RDI shows its most significant effect on the Social score (0.726***). CLS remains significant across all components, indicating broad applicability. The disaggregation of ESG scores reveals that GHG emissions have the greatest influence on Environmental scores, suggesting that environmental initiatives are being prioritized to bolster overall ESG performance. This finding underscores the centrality of emissions-related strategies in driving ESG outcomes.

The cross-sectional heterogeneity analysis presented in Table 7 provides additional insights into the heterogeneity of the relationships between ESG performance and its determinants under varying firm characteristics, i.e., sample characteristics, to avoid sample biases.

GHG emission intensity remains positive and significant, suggesting that the relationship between GHG emissions and ESG performance is not driven solely by firms in China (Model 1). RDI and CLS also maintain their significance, indicating the broader applicability of the findings across other Asian countries. When environmentally sensitive industries are excluded, the coefficients for GHG and RDI remain robust, highlighting that the results are not disproportionately influenced by high-emission industries (Model 2). Using a matched sample to control for potential selection bias, this approach further validates the robustness of the findings and reduces concerns about omitted variable bias (Model 3). To account for potential distortions caused by the pandemic, the analysis excludes the COVID-19 period (Model 4). The results for GHG, RDI, and CLS continue to show positive and significant effects, indicating that the observed relationships are not artefacts of the pandemic-induced disruptions. These additional analyses collectively further affirm the reliability of the baseline results and demonstrate that the relationships between ESG performance and the key explanatory variables hold across various subsamples and methodological adjustments. The consistent significance of GHG, RDI, and CLS further underscores their role in shaping ESG outcomes among sample Asian firms.

Further additional analysis shown in Table 8 reveals that the positive relationship between GHG and ESG performance is stronger for firms with lower GHG emissions than for high-GHG emitters. Guided by NIT, the findings suggest that high-GHG firms enhance their ESG performance to maintain legitimacy through symbolic practices, whereas low-GHG firms achieve stronger ESG impacts by aligning with substantive environmental initiatives. High-RDI firms demonstrate a significant, positive relationship with ESG performance, whereas low-RDI firms exhibit a stronger coefficient. This highlights the transformative role of innovation in low-RDI firms, where targeted investments may yield significant ESG gains. The relationship between CLS and ESG performance varies across contexts. High-CLS firms exhibit a slightly negative coefficient, whereas low-CLS firms show a positive and significant effect, suggesting

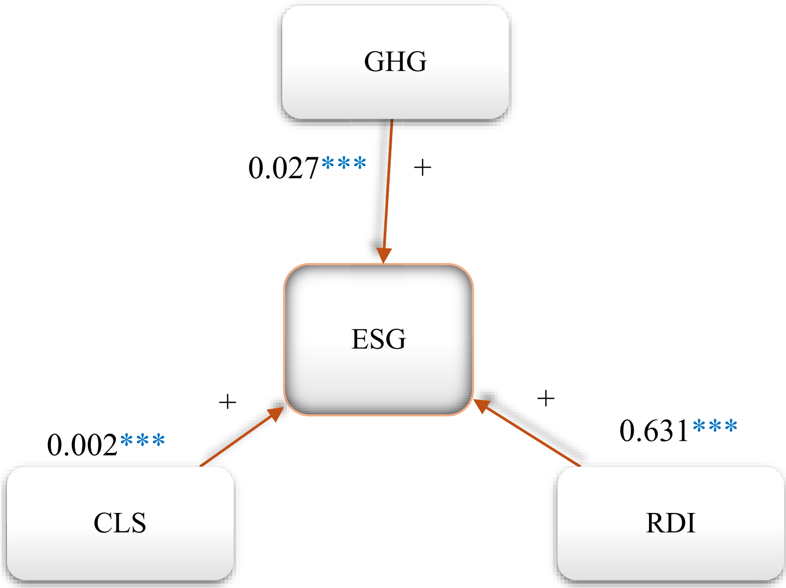

FIGURE 4 | Plot of baseline regression coefficients.

TABLE 5 | Methods of moments quantile regression.

	The dependent variable is ESG performance						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	**Location**	**Scale**	**Q10**	**Q25**	**Q50**	**Q75**	**Q95**
GHG	0.026***	0.005***	0.020***	0.022***	0.026***	0.030***	0.035***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
RDI	0.709***	0.136***	0.513***	0.578***	0.697***	0.831***	0.972***
	(0.056)	(0.030)	(0.062)	(0.056)	(0.055)	(0.068)	(0.090)
CLS	0.001***	0.000	0.001***	0.001***	0.001***	0.001**	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,177	20,177	20,177	20,177	20,177	20,177	20,177
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents our moment quantile regression analysis results, including year- and country-fixed effects. Below the coefficients, the standard errors are presented in parentheses, and asterisks ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

that operational efficiencies in low-CLS firms better align with ESG goals. Smaller firms demonstrate a stronger positive relationship than larger firms, underscoring their agility in adopting ESG practices. Firms operating in highly concentrated markets (high HHI) show a stronger positive coefficient compared with those in less concentrated markets. This could reflect competitive pressures in concentrated markets to adopt superior ESG practices as a differentiator.

Overall, these results underscore the importance of considering firm-specific characteristics when evaluating the determinants of ESG performance. The nuanced impacts of GHG, RDI, and CLS across different contexts provide actionable insights for policymakers, managers, and investors seeking to promote sustainable practices. The consistent significance of GHG, RDI, and CLS further reinforces the importance of these factors in shaping ESG outcomes in Asian firms.

5.5 | Robustness Analyses

Alternative methodological approaches and measures are employed to ensure the robustness of findings. In Table 9, Model 1 uses an industry-average GHG (IA_GHG) measure. Main results remain consistent, with GHG exhibiting a positive and significant relationship (0.029***). Model 2 incorporates additional controls, including market concentration (HHI), Tobin's Q (TQR), asset tangibility (ATA), and inflation (INF). The coefficients for

GHG (0.029***), RDI (0.610***), and CLS (0.002***) remain significant, highlighting that the relationships are not sensitive to the inclusion of these macroeconomic and firm-specific factors. Model 3 employs a two-step GMM approach to address potential endogeneity. The coefficients for GHG (0.014***), RDI (0.194**), and CLS (0.003***) remain positive and significant, further validating the robustness of the findings.

TABLE 6 | Additional analysis: Disaggregation of ESG Scores.

Variables	(1) E score	(2) S score	(3) G score
GHG	0.034***	0.028***	0.017***
	(0.002)	(0.002)	(0.002)
RDI	0.500***	0.726***	0.344***
	(0.107)	(0.143)	(0.071)
CLS	0.002***	0.002**	0.001
	(0.001)	(0.001)	(0.001)
Controls	Yes	Yes	Yes
Observations	20,177	20,177	20,177
Adj. R^2	0.481	0.461	0.347
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes

Note: This table presents the disaggregation ESG Scores analysis results, including year- and country-fixed effects. Below the coefficients, the standard errors are presented in parentheses, and asterisks ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

These robustness checks provide comprehensive evidence of the robustness and reliability of the observed relationships between ESG performance and its determinants. The use of alternative measures and advanced methodologies reinforces the credibility of the results, offering deeper insights into the mechanisms underlying ESG outcomes in Asian firms. The consistent significance of GHG, RDI, and CLS further underscores their role in shaping ESG outcomes in Asian firms.

5.6 | Discussion of Results

This study examines the relationships between GHG emissions intensity, RDI, and CLS and ESG performance among Asian firms over 2015–2023, employing robust econometric methods, including OLS, fixed effects, GMM, and quantile regression. The findings reveal nuanced dynamics that both support and extend NIT and RBV arguments, while challenging conventional assumptions about sustainability performance.

Specifically, empirical results strongly support Hypothesis 1, confirming a counterintuitive positive association between GHG emissions intensity and ESG performance. This accords with NIT, evidencing that institutional pressures appear to incentivize emission-intensive firms to enhance ESG performance through strategic responses to coercive and normative demands. Organisations under intense institutional scrutiny adopt practices to maintain legitimacy rather than purely for operational efficiency (DiMaggio and Powell 1983; Nicolo et al. 2025). Consistent with recent evidence (Haque and Ntim 2020; Treepongkaruna et al. 2024), higher emitting firms can achieve strong ESG ratings through enhanced sustainability disclosure and stakeholder engagement strategies. The relationship is particularly pronounced in the disaggregated analysis, where GHG

TABLE 7 | Additional analysis: Cross-sectional heterogeneity and sample biases.

	The dependent variable is ESG performance.			
Variables	(1) Excluding Chinese firms	(2) Excluding env. sensitive industries	(3) PSM sample	(4) Excluding COVID period
GHG	0.036***	0.028***	0.022***	0.027***
	(0.002)	(0.001)	(0.001)	(0.001)
RDI	0.693***	0.715***	1.514***	0.635***
	(0.195)	(0.061)	(0.106)	(0.061)
CLS	0.002***	0.001*	0.002***	0.001***
	(0.001)	(0.000)	(0.001)	(0.000)
Controls	Yes	Yes	Yes	Yes
Observations	15,189	16,969	14,442	15,492
Adj. R^2	0.538	0.416	0.420	0.466
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

Note: This table presents cross-sectional heterogeneity analysis results, including year- and country-fixed effects. Below the coefficients, the standard errors are presented in parentheses, and asterisks ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

TABLE 8 | Additional analysis: High- and low-value samples.

	The dependent variable is ESG performance.									
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Variables	**High GHG**	**Low GHG**	**High RDI**	**Low RDI**	**High CLS**	**Low CLS**	**Big firms**	**Small firms**	**High HHI**	**Low HHI**
GHG	0.014***	0.033***	0.024***	0.026***	0.029***	0.027***	0.025***	0.027***	0.034***	0.026***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
RDI	0.861***	0.324***	0.130**	7.224***	0.633***	0.318***	1.246***	0.216***	0.718***	0.639***
	(0.076)	(0.074)	(0.061)	(0.557)	(0.062)	(0.103)	(0.083)	(0.064)	(0.090)	(0.067)
CLS	0.001*	0.003***	0.005***	0.001**	−0.023***	0.002***	0.001***	0.002***	0.001**	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.003)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,841	5015	4808	14,048	13,290	5566	11,856	7000	7865	10,990
Adj. R^2	0.436	0.416	0.496	0.446	0.466	0.363	0.398	0.384	0.453	0.418
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the mechanism analysis results with year- and country-fixed effects. High- and low-value samples are categorized based on the variable's median, with values above the median labelled as high and those below as low. Standard errors are reported in parentheses below the coefficients, and significance levels are indicated by ***, **, and * for 1%, 5%, and 10%, respectively.

TABLE 9 | Robustness analyses.

	The dependent variable is ESG performance.		
	(1)	(2)	(3)
Variables	ESG	ESG	GMM
Lagged ESG			0.730***
			(0.011)
GHG		0.029***	0.014***
		(0.001)	(0.002)
IA_GHG	0.020***		
	(0.001)		
RDI	0.608***	0.610***	0.194**
	(0.054)	(0.053)	(0.097)
CLS	0.002***	0.002***	0.003***
	(0.001)	(0.001)	(0.001)
HHI		0.028***	
		(0.007)	
TQR		0.002***	
		(0.000)	
ATA		−0.025**	
		(0.010)	
INF		−0.010***	
		(0.000)	
Controls	Yes	Yes	Yes
Observations	20,177	20,177	20,177
Adj. R^2	0.412	0.444	
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
AR2			0.271
Sargan			0.363

Note: This table presents robustness analysis results with year- and country-fixed effects. The Arellano–Bond AR2 test evaluates the serial correlation of order i using residuals in first differences, with an asymptotic $N(0,1)$ distribution under the null hypothesis, indicating no serial correlation. The Sargan test assesses overidentifying restrictions with an asymptotic chi-squared (χ^2) distribution under the null hypothesis, confirming no correlation between the instruments and the error term. Standard errors are presented in parentheses below the coefficients, with significance levels denoted by ***, **, and * for 1%, 5%, and 10%, respectively.

emissions exert the strongest influence on Environmental scores, suggesting that emission-intensive firms strategically prioritize environmental reporting and governance mechanisms to offset negative perceptions associated with their carbon footprint.

The quantile regression results reveal important heterogeneity in this relationship, with stronger GHG–ESG associations at higher performance quantiles compared to lower ones. This pattern suggests a sophisticated interplay between symbolic and substantive responses to institutional pressures. Lower performing firms may rely primarily on disclosure-based legitimacy strategies, whereas top-tier ESG performers appear to achieve deeper environmental integration, consistent with Van Binsbergen and Brøgger's (2022) findings that distinguish between superficial reporting and genuine operational changes. This heterogeneity supports the notion that institutional pressures can drive both greenwashing behaviors and authentic sustainability transformations, depending on firms' capabilities and strategic orientations.

Hypothesis 2 also receives robust support, with RDI consistently exhibiting positive effects on ESG performance. These results accord with RBV, which emphasizes internal capabilities as drivers of sustainable competitive advantage. The particularly strong effect among low-RDI firms highlights innovation's transformative potential in resource-constrained settings, echoing cross-industry evidence from Fu et al. (2020) and Li and Xu (2024) that R&D investment drives both emissions reductions and broader environmental improvements. The disaggregated analysis shows that RDI exerts its most decisive influence on Social scores, extending Padgett and Galan's (2010) environmental focus to demonstrate how innovation capabilities enhance community engagement and workforce-development initiatives. Taken together, these patterns suggest that RDI constitutes a valuable, rare, and difficult-to-imitate resource that enables firms to address multiple stakeholder expectations simultaneously. Last, the empirical support for Hypothesis 3 demonstrates that CLS significantly enhances ESG performance, validating the initial expectation that operational efficiency aligns naturally with sustainability objectives. The RBV's predictions are evident in how CLS creates systematic capabilities in waste minimization and energy efficiency that simultaneously reduce costs and environmental impact (Uyar et al. 2022). So, firms with lower initial reliance on CLSs experience stronger ESG improvements, suggesting that efficiency-focused practices represent meaningful strategic shifts rather than incremental optimization.

Collectively, the study's findings reveal how institutional pressures and internal capabilities interact to shape ESG outcomes beyond simple linear relationships. The positive association between GHG emissions and ESG performance challenges assumptions that environmental responsibility requires emission reductions, highlighting how institutional legitimacy can be maintained through enhanced transparency and governance practices. This reflects the complex interplay between symbolic and substantive responses to stakeholder expectations. The strong performance of both RDI and CLS underscores the complementary nature of innovation and efficiency strategies in building sustainable competitive advantages. RDI enables firms to develop new solutions and signal long-term commitment, whereas CLS embeds sustainability principles into core operational processes. Together, these capabilities create robust foundations for credible ESG performance extending beyond mere compliance.

6 | Conclusions, Limitations, and Future Research Directions

This study examined the relationships between GHG emissions intensity, RDI, CLS, and ESG performance among Asian firms over 2015–2023. Using a comprehensive econometric research design, including OLS, fixed effects, GMM, and quantile regression, the study provided robust empirical evidence that challenges conventional assumptions about sustainability performance while advancing theoretical understanding of corporate ESG strategies. Specifically, the findings highlighted three relationships that reframe ESG dynamics in emerging markets. First, a positive association between GHG emissions intensity and ESG performance is documented, suggesting that higher emitting firms strategically enhance ESG ratings chiefly through expanded disclosure and governance mechanisms rather than symbolic emissions reductions. Second, R&D intensity emerges as a critical driver of ESG performance, with powerful effects among resource-constrained firms and pronounced impacts on the Social pillar. Third, a CLS shows a significant positive association with ESG outcomes, indicating that operational efficiency and sustainability objectives can be mutually reinforcing rather than competing priorities.

The quantile regression analysis revealed marked heterogeneity in these relationships, with stronger associations at higher levels of ESG performance. This pattern suggests that top-performing firms achieve more substantive environmental integration, whereas lower performers may rely more heavily on symbolic practices. Such heterogeneity offers nuanced insight into the complex interplay between institutional pressures and organisational capabilities in shaping sustainability outcomes. This study provides different theoretical contributions to the corporate sustainability and ESG literatures. First, it extends NIT's arguments by highlighting how legitimacy-seeking behaviors can generate positive associations between environmental liabilities and ESG performance. Although prior research has emphasized the symbolic nature of corporate environmental responses, the findings reveal a more nuanced dynamic in which institutional pressures incentivize high-emitting firms to enhance transparency and governance practices, yielding higher ESG ratings despite persistent emissions intensity. This challenges conventional assumptions about the relationship between environmental performance and ESG outcomes and highlights the sophisticated mechanisms through which firms manage stakeholder expectations.

Second, the study contributes to the RBV domain by identifying RDI and CLS as critical organisational capabilities that drive ESG performance through distinct pathways. RDI constitutes a valuable, rare, and hard-to-imitate resource that enables firms to address multiple stakeholder expectations simultaneously, particularly along the Social dimension. Likewise, CLS embeds sustainability principles within core operational processes, creating a natural alignment between efficiency and environmental stewardship. These insights extend the RBV by showing how seemingly divergent strategic orientations can both underpin sustainable competitive advantage. Third, the study advances understanding of ESG heterogeneity by showing that the relationships between organisational characteristics and ESG performance vary across performance levels. The quantile regression results indicate that institutional pressures and internal capabilities interact differently depending on a firm's baseline ESG positioning: top performers exhibit deeper integration of sustainability principles, whereas lower performers rely more on disclosure-led strategies. This underscores the importance of modeling performance heterogeneity in ESG research and cautions against one-size-fits-all theoretical claims.

Finally, the study contributes to the nascent literature on ESG authenticity by providing empirical evidence that distinguishes between symbolic and substantive corporate responses to sustainability pressures. Although concerns about greenwashing are warranted, the results suggest that ESG markets may be more discerning than critics contend, with stakeholders and rating agencies distinguishing between superficial disclosures and genuine capability development. This perspective helps reconcile competing views on ESG effectiveness and offers a more nuanced framework for understanding corporate sustainability strategy.

The findings offer actionable insights for multiple stakeholder groups navigating the complex landscape of corporate sustainability and ESG performance. For corporate managers, they suggested that ESG enhancement strategies can be tailored to firms' specific emissions profiles and capability endowments rather than follow generic best practices. High-emitting firms can leverage enhanced transparency, robust governance mechanisms, and proactive stakeholder engagement to maintain legitimacy while developing longer term capabilities to reduce emissions. This approach recognizes that immediate operational transformation may not be feasible for all firms, while still providing pathways for meaningful ESG improvement.

Managers are further encouraged to prioritize R&D investment as a cornerstone of ESG strategy, given the broad impacts of innovation capabilities across ESG dimensions. The evidence indicates that RDI not only drives environmental improvements but also enhances social performance through community engagement and workforce-development initiatives. Thus, innovation investment can serve the dual purpose of building competitive advantage while addressing diverse stakeholder expectations.

For investment professionals and ESG analysts, the findings underscore the importance of distinguishing between symbolic and substantive corporate responses to sustainability pressures. The positive association between GHG emissions and ESG scores should not be automatically interpreted as greenwashing, but rather as a reflection of institutional dynamics that incentivize transparency among high emitters. Attention should be directed to firms' capability development in innovation and operational efficiency as indicators of genuine sustainability commitment, recognizing that ESG improvement pathways may vary markedly across performance levels. Policymakers may benefit from understanding how regulatory frameworks and institutional pressures shape corporate ESG strategies. The results suggest that disclosure mandates and stakeholder expectations can catalyze meaningful improvements in governance and transparency practices, even when immediate operational changes are not feasible. Nevertheless, complementary measures that support capability development in innovation and operational efficiency should be considered to ensure that symbolic responses evolve into substantive sustainability improvements over time.

Although this study provides valuable insights into the relationships between organizational characteristics and ESG performance, several limitations should be acknowledged. First, the focus on Asian firms from 2015 to 2023 may limit the generalizability of findings to other geographic contexts or time periods. Different institutional environments, regulatory frameworks, and cultural contexts may influence how NIT and RBV mechanisms operate in practice. Future research should examine these relationships across diverse geographic and institutional settings to enhance external validity. Second, this study's empirical analyses rely on ESG ratings from commercial providers, which may introduce measurement bias or reflect specific methodological approaches that do not capture all dimensions of sustainability performance. Although disaggregated ESG components yield more granular insights, future studies could benefit from incorporating alternative ESG measurement approaches—such as stakeholder-based assessments and outcome-based environmental metrics—to validate results across different conceptualisations of ESG performance. Third, although endogeneity concerns are addressed through GMM estimation and fixed-effects specifications, the complex relationships between organizational characteristics and ESG performance are likely to involve feedback mechanisms and dynamic interactions that are difficult to capture with cross-sectional or standard panel methods. Longitudinal case studies or quasi-experimental designs could provide deeper insight into the causal mechanisms underpinning these relationships.

Endnotes

[1] Research by van Binsbergen and Brøgger (2022) and Bams and van der Kroft (2022) suggests that ESG ratings may inadequately capture actual environmental performance, particularly for high-emission firms, thus reinforcing concerns about greenwashing and symbolic compliance.

[2] The resource-based view (Barney 1991) emphasizes that internal capabilities such as R&D and cost efficiency enable firms to integrate sustainability into operations. R&D enhances eco-innovation and energy efficiency (Fu et al. 2020; Padgett and Galan 2010; Tan et al. 2024), whereas cost leadership aligns with ESG goals through waste reduction and resource optimization (Al-Shaer et al. 2024; Uyar et al. 2022).

[3] For detail information, see https://thesource.refinitiv.com/thesource/getfile/index/4933f0a6-476e-4a30-adbb-df8043d2c33f.

[4] Detailed methods of emission data are available at https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-climate-data-package-ghg-emissions-methodology-process.pdf.

References

Al-Shaer, H., C. Kuzey, A. Uyar, and A. S. Karaman. 2024. "Corporate Strategy, Board Composition, and Firm Value." *International Journal of Finance and Economics* 29, no. 3: 3177–3202. https://doi.org/10.1002/ijfe.2827.

Ardia, D., K. Bluteau, K. Boudt, and K. Inghelbrecht. 2022. "Climate Change Concerns and the Performance of Green vs. Brown Stocks." *Management Science* 69, no. 12: 7607–7632. https://doi.org/10.1287/mnsc.2022.4636.

Asimakopoulos, P., S. Asimakopoulos, and X. Li. 2023. "The Role of Environmental, Social, and Governance Rating on Corporate Debt Structure." *Journal of Corporate Finance* 83: 102488. https://doi.org/10.1016/j.jcorpfin.2023.102488.

Bagh, T., E. Bouri, and M. A. Khan. 2024. "Climate Change Sentiment, ESG Practices and Firm Value: International Insights." *China Finance Review International*, forthcoming. https://doi.org/10.1108/CFRI-07-2024-0381.

Bams, D., & van der Kroft, B. (2022). *Tilting the Wrong Firms? How Inflated ESG Ratings Negate Socially Responsible Investing Under Information Asymmetries*. MIT Center for Real Estate Research Paper,22(12), 1–33, Massachusetts, USA https://doi.org/10.2139/ssrn.4126986.

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage." *Journal of Management* 17, no. 1: 99–120. https://doi.org/10.1177/014920639101700108.

Berkman, H., J. Jona, and N. Soderstrom. 2024. "Firm-Specific Climate Risk and Market Valuation." *Accounting, Organizations and Society* 112: 101547. https://doi.org/10.1016/j.aos.2024.101547.

Berrone, P., A. Fosfuri, and L. Gelabert. 2017. "Does Greenwashing Pay Off? Understanding the Relationship Between Environmental Actions and Environmental Legitimacy." *Journal of Business Ethics* 144, no. 2: 363–379. https://doi.org/10.1007/s10551-015-2816-9.

Bolton, P., and M. Kacperczyk. 2021. "Do Investors Care About Carbon Risk?" *Journal of Financial Economics* 142, no. 2: 517–549. https://doi.org/10.1016/j.jfineco.2021.05.008.

Bolton, P., and M. Kacperczyk. 2023. "Global Pricing of Carbon-Transition Risk." *Journal of Finance* 78, no. 6: 3677–3754. https://doi.org/10.1111/jofi.13272.

Bui, B., O. Moses, and M. N. Houqe. 2020. "Carbon Disclosure, Emission Intensity and Cost of Equity Capital: Multi-Country Evidence." *Accounting and Finance* 60, no. 1: 47–71. https://doi.org/10.1111/acfi.12492.

Carungu, J., R. Di Pietra, M. Molinari, and G. Nicolò. 2025. "Confronting Sustainability Grand Challenges: How Do Standard-Setters Shape Sustainability Reporting Standards and Accountability Practices?" *Accounting, Auditing & Accountability Journal* Forthcoming, https://doi.org/10.1108/AAAJ-06-2024-7142

Chasiotis, I., D. Gounopoulos, D. Konstantios, and V. Patsika. 2024. "ESG Reputational Risk, Corporate Payouts and Firm Value." *British Journal of Management* 35, no. 2: 871–892. https://doi.org/10.1111/1467-8551.12745.

Cohen, L., U. G. Gurun, and Q. H. Nguyen. 2020. *The ESG-Innovation Disconnect: Evidence From Green Patenting (Working Paper)*. National Bureau of Economic Research. https://doi.org/10.3386/w27990.

Dahlmann, F., L. Branicki, and S. Brammer. 2019. "Managing Carbon Aspirations: The Influence of Corporate Climate Change Targets on Environmental Performance." *Journal of Business Ethics* 158, no. 1: 1–24. https://doi.org/10.1007/s10551-017-3731-z.

DiMaggio, P. J., and W. W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48, no. 2: 147–160. https://www.jstor.org/stable/2095101.

Dyck, A., K. V. Lins, L. Roth, and H. F. Wagner. 2019. "Do Institutional Investors Drive Corporate Social Responsibility? International Evidence." *Journal of Financial Economics* 131, no. 3: 693–714. https://doi.org/10.1016/j.jfineco.2018.08.013.

Fu, L., D. Boehe, and M. Orlitzky. 2020. "Are R&D-Intensive Firms Also Corporate Social Responsibility Specialists? A Multicountry Study." *Research Policy* 49, no. 8: 104082. https://doi.org/10.1016/j.respol.2020.104082.

Güney, T. 2024. "How Effective Is Business Climate on CO_2 Emissions? A MMQR Analysis for OECD Countries." *Journal of Environmental Management* 370: 122893. https://doi.org/10.1016/j.jenvman.2024.122893.

Haque, F., and C. G. Ntim. 2020. "Executive Compensation, Sustainable Compensation Policy, Carbon Performance and Market Value." *British Journal of Management* 31, no. 3: 525–546. https://doi.org/10.1111/1467-8551.12395.

Hussain, N., U. Rigoni, and E. Cavezzali. 2018. "Does It Pay to Be Sustainable? Looking Inside the Black Box of the Relationship Between Sustainability Performance and Financial Performance." *Corporate*

Social Responsibility and Environmental Management 25, no. 6: 1198–1211. https://doi.org/10.1002/csr.1631.

Kabongo, J. D. 2019. "Sustainable Development and Research and Development Intensity in US Manufacturing Firms." *Business Strategy and the Environment* 28, no. 4: 556–566. https://doi.org/10.1002/bse.2264.

Kim, S., G. Lee, and H.-G. Kang. 2021. "Risk Management and Corporate Social Responsibility." *Strategic Management Journal* 42, no. 1: 202–230. https://doi.org/10.1002/smj.3224.

Li, J., and X. Xu. 2024. "Can ESG Rating Reduce Corporate Carbon Emissions?—An Empirical Study From Chinese Listed Companies." *Journal of Cleaner Production* 434: 140226. https://doi.org/10.1016/j.jclepro.2023.140226.

Liesen, A., A. G. Hoepner, D. M. Patten, and F. Figge. 2015. "Does Stakeholder Pressure Influence Corporate GHG Emissions Reporting? Empirical Evidence From Europe." *Accounting, Auditing & Accountability Journal* 28, no. 7: 1047–1074. https://doi.org/10.1108/AAAJ-12-2013-1547.

LSEG. 2023. *Environmental, Social and Governance Scores From LSEG*. London Stock Exchange Group. https://thesource.refinitiv.com/thesource/getfile/index/4933f0a6-476e-4a30-adbb-df8043d2c33f Date Access 10/06/2025.

LSEG. 2024. *Company Estimated Greenhouse Gases (GHG) Emissions in LSEG (Ed.), Climate Data*. London Stock Exchange Group. https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf. Date Access 10/10/2025.

Luo, L., Y.-C. Lan, and Q. Tang. 2012. "Corporate Incentives to Disclose Carbon Information: Evidence From the CDP Global 500 Report." *Journal of International Financial Management & Accounting* 23, no. 2: 93–120. https://doi.org/10.1111/j.1467-646X.2012.01055.x.

Machado, J. A. F., and S. J. M. C. Santos. 2019. "Quantiles via Moments." *Journal of Econometrics* 213, no. 1: 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009.

Matsumura, E. M., R. Prakash, and S. C. Vera-Muñoz. 2014. "Firm-Value Effects of Carbon Emissions and Carbon Disclosures." *Accounting Review* 89, no. 2: 695–724. https://doi.org/10.2308/accr-50629.

Meyer, J. W., and B. Rowan. 1977. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83, no. 2: 340–363. https://doi.org/10.1086/226550.

Nicolo', G., and J. M. Cervilla-Bellido. 2025. "Investigating the Antecedents of Sustainable Development Goals Disclosure via Social Media: Evidence From Water Companies." *Corporate Social Responsibility and Environmental Management* 32, no. 2: 2317–2331.

Nicolo, G., G. Zampone, G. Sannino, and P. T. Polcini. 2025. "Ready for Change After the Omnibus Package? Early Compliance With the European Sustainability Reporting Standards and Its Key Determinants in the New Regulatory Era." *Business Strategy and the Environment* Forthcoming, https://doi.org/10.1002/bse.70054.

Nunes, P. M., Z. Serrasqueiro, and J. Leitão. 2012. "Is There a Linear Relationship Between R&D Intensity and Growth? Empirical Evidence of Non-High-Tech vs. High-Tech SMEs." *Research Policy* 41, no. 1: 36–53. https://doi.org/10.1016/j.respol.2011.08.011.

Oyewo, B., V. Tauringana, V. Tawiah, and O. Aju. 2024. "Impact of Country Governance Mechanisms on Carbon Emissions Performance of Multinational Entities." *Journal of Environmental Management* 352: 120000. https://doi.org/10.1016/j.jenvman.2023.120000.

Padgett, R. C., and J. I. Galan. 2010. "The Effect of R&D Intensity on Corporate Social Responsibility." *Journal of Business Ethics* 93, no. 3: 407–418. https://doi.org/10.1007/s10551-009-0230-x.

Raghunandan, A., and S. Rajgopal. 2022. "Do ESG Funds Make Stakeholder-Friendly Investments?" *Review of Accounting Studies* 27, no. 3: 822–863. https://doi.org/10.1007/s11142-022-09693-1.

Suddaby, R., D. Seidl, and J. K. Lê. 2013. "Strategy-As-Practice Meets Neo-Institutional Theory." *Strategic Organization* 11, no. 3: 329–344. https://doi.org/10.1177/1476127013497618.

Tan, W., Y. Cai, H. Luo, M. Zhou, and M. Shen. 2024. "ESG, Technological Innovation and Firm Value: Evidence From China." *International Review of Financial Analysis* 96: 103546. https://doi.org/10.1016/j.irfa.2024.103546.

Treepongkaruna, S., H. H. Au Yong, S. Thomsen, and K. Kyaw. 2024. "Greenwashing, Carbon Emission, and ESG." *Business Strategy and the Environment* 33, no. 8: 8526–8539. https://doi.org/10.1002/bse.3929.

Uyar, A., M. A. Koseoglu, C. Kuzey, and A. S. Karaman. 2022. "Does Firm Strategy Influence Corporate Social Responsibility and Firm Performance? Evidence From the Tourism Industry." *Tourism Economics* 29, no. 5: 1272–1301. https://doi.org/10.1177/13548166221102806.

Van Binsbergen, J. H., & Brøgger, A. (2022). *The Future of Emissions*. SSRN https://doi.org/10.2139/ssrn.4241164.

Wang, J., A. Osei, and A. O. Agyemang. 2025. "Leveraging Green Innovation and Eco-Technology for Sustainable Competitive Advantage: Firm-Level Productivity Analysis in China and the United States." *Business Strategy and the Environment* (Forthcoming) 34: 7389–7411. https://doi.org/10.1002/bse.4360.

Wedari, L. K., C. Jubb, and A. Moradi-Motlagh. 2021. "Corporate Climate-Related Voluntary Disclosures: Does Potential Greenwash Exist Among Australian High Emitters Reports?" *Business Strategy and the Environment* 30, no. 8: 3721–3739. https://doi.org/10.1002/bse.2836.

Zhang, D. 2023. "Does Green Finance Really Inhibit Extreme Hypocritical ESG Risk? A Greenwashing Perspective Exploration." *Energy Economics* 121: 106688. https://doi.org/10.1016/j.eneco.2023.106688.