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What Determines Country-Level ESG Performance?

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ABSTRACT

This study provides empirical evidence on the country-level dynamics of ESG performance using two novel composite indicators across a panel of 123 countries from 2006 to 2022. A distributionally robust estimation strategy is employed, whereby method of moments panel quantile regression is adopted to take account for the non-normal distributional properties of ESG scores and to reveal potential asymmetries across the conditional distribution. Results complemented by two-way fixed effects and random effects models consistently show that socioeconomic development, resilient economy, rule of law, strong democratic institutions and international cooperation have positive and statistically significant effects on country-level ESG performance. The magnitude and significance of these effects vary across the conditional distribution of ESG scores, indicating that the strength of determinants is not uniform across countries but instead contingent upon their existing ESG performance levels.

1 | Introduction

Over the past decade, environmental, social, and governance (ESG) performance has become a prominent benchmark for assessing firm-level responsibility in environmental sustainability and social accountability. Accordingly, the literature has expanded with empirical studies examining ESG determinants and impacts at the corporate level (Alessandrini and Jondeau 2021; Amel-Zadeh and Serafeim 2021; Demers et al. 2021; Pedersen et al. 2021; Savio et al. 2023; Baek and Song 2024; Jiang 2024; Köhler 2013). However, ESG performance at the country level remains relatively underexplored despite the fact that ESG frameworks have growing relevance beyond the firm level.

For governments, ESG offers a structured approach to aligning development strategies with sustainability goals through promoting responsible investment, safeguarding social equity and reinforcing institutional transparency (Khan 2016). In particular, ESG principles are now seen as foundational to achieving carbon neutrality pledges and long-term resilience. The COVID-19 pandemic has further underscored the need to address environmental degradation and public health vulnerabilities, elevating ESG to a central pillar in national recovery strategies (Chen et al. 2023). From a policy perspective, measuring ESG performance at the country level enables governments to address climate change, enhance social welfare and strengthen institutional quality, ultimately contributing to a more integrated approach to sustainable development.

Nonetheless, most existing studies still treat ESG either as a corporate reporting tool or as a loosely defined set of indicators, with limited attention to its policy implications. Much of the existing research relies on self-reported corporate data, emphasizing disclosure rather than evaluating the actual outcomes of ESG-aligned policies (Sulkowski and Jebe 2022). This focus limits our understanding of how ESG principles contribute to progress on the sustainable development goals (SDGs) at a national scale.

A national-level ESG framework enables a more holistic evaluation of SDG progress by accounting for country-specific governance capacities, regulatory quality, social development and environmental stewardship. Without such a macro-level perspective, ESG assessments risk being fragmented, overlooking the structural enablers or constraints that determine real-world sustainability outcomes. While some cross-country studies have incorporated ESG indicators (Crifo et al. 2015; Diaye et al. 2022; Ho et al. 2019; Tanjung 2021; Wang et al. 2023; Wang et al. 2023), their empirical findings remain mixed. These studies often rely on narrow indicator sets or limited country samples, leaving a significant gap in the literature on national ESG performance.

This paper seeks to address that gap by providing new cross-country evidence on what shapes ESG performance, using a sample of 123 countries. We aim to contribute to the growing literature on sustainability by examining ESG at the macro level with two novel composite ESG performance indices. We also make a methodological contribution by applying a distributionally robust framework that uncovers heterogeneous effects of institutional, economic and governance-related drivers across the ESG performance spectrum. We also complement our findings using fixed effects and random effects panel models.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the theoretical framework. Section 4 details the data and variables. Section 5 discusses the methodology and empirical findings. Section 6 concludes with policy implications.

2 | Literature Review

Although earlier studies such as Martiny et al. (2024) have provided comprehensive overviews of ESG-related research, this section selectively reviews findings that are most relevant to the present analysis. The literature on ESG performance has grown substantially in recent years, reflecting increased interest among academics, policymakers and investors; see Zhong et al. (2025) and Pan et al. (2025). However, critical reviews suggest that this body of work remains fragmented and often suffers from methodological limitations (Martiny et al. 2024).

A growing number of empirical studies have investigated the determinants of ESG performance. Many of these studies focus on a narrow set of explanatory variables, adopt a limited geographical scope, or rely exclusively on data from a single ESG rating provider. These limitations have constrained the generalizability of findings and have contributed to inconsistencies and contradictions across studies.

While there is a growing interest in aligning ESG indicators with the SDGs, most studies remain focused on firm-level disclosure metrics rather than actual ESG performance at the national level. Among the few exceptions, Crifo et al. (2015) find a negative relationship between country-level ESG performance and sovereign borrowing costs using a sample of 23 OECD countries. Diaye et al. (2022) explore similar macroeconomic implications of ESG but also limit their analysis to OECD countries. Ho et al. (2019), in contrast, adopt a simplified approach by using three indicators: CO_2 emissions for environmental performance, life expectancy for the social dimension, and corruption levels for governance.

On the other hand, Tanjung (2021) examines the relationship between sustainable development and economic growth in nine emerging market economies. In a similar more recent study, Wang et al. (2023) provide broader evidence, demonstrating that improvements in national ESG performance have a significant and positive impact on economic growth in a sample of 109 countries. The study identifies key transmission mechanisms such as enhanced energy efficiency, human capital development, and increased foreign investment. These effects remain robust after addressing potential endogeneity concerns. Notably, the growth-enhancing impact of ESG performance is strongest in high-income countries and major greenhouse gas emitters, while relatively weaker in resource-dependent economies.

While these contributions are valuable, they can be criticized on the grounds that they are often constrained by small samples, region-specific focus, or arbitrarily selected ESG indicators. More importantly, they do not offer a detailed explanation of the mechanisms through which country-level sustainability efforts influence long-term economic outcomes. Most of these studies continue to treat ESG performance as an outcome variable and focus primarily on its effects on macroeconomic indicators such as growth, borrowing costs or investment flows. While this line of inquiry is valuable, it leaves a critical gap in the literature concerning the drivers of ESG performance at the country level itself.

With the exception of a handful of studies (Crifo et al. 2015; Diaye et al. 2022; Ho et al. 2019; Tanjung 2021; Wang et al. 2023; Wang et al. 2023), there has been little effort to systematically explore the structural, institutional and developmental conditions that shape ESG dynamics across countries. As a result, our understanding of why ESG performance varies across national contexts and how this variation reflects deeper socioeconomic and governance-related foundations remains limited. The present article aims to fill this gap in the existing literature.

3 | Theoretical Framework

From a theoretical perspective, shifting the focus from ESG disclosure to actual performance at the country level is essential for aligning ESG practices with the core objectives of the SDGs. Since the adoption of the 2030 Agenda for Sustainable Development, scholars and policymakers have increasingly recognized the conceptual alignment between the SDGs and the ESG framework (Mooij 2018; Zhang et al. 2024; Gui and Lu 2024; Ha and Joo 2025). The urgency to integrate these frameworks has grown amid intensifying climate-related disasters, persistent social inequities and mounting governance failures.

Current ESG disclosure frameworks at the firm level tend to emphasize transparency and standardization in reporting, but they often fall short of capturing the real-world effectiveness of ESG policies (see Lukács and Rickards 2023). This focus is consistent with institutional theory, which underscores the importance of formal rules, governance quality, and regulatory stability in shaping long-term developmental outcomes. It also aligns with stakeholder theory, which highlights the broader responsibilities of institutions to serve diverse societal interests. However, while these disclosures are commonly shaped by reputational incentives and compliance mandates, country-level performance provides a more substantive reflection of how well public institutions, legal systems and development policies are functioning (Martiny et al. 2024).

Emphasizing ESG performance over disclosures enables a more credible and policy-relevant evaluation of progress towards sustainability, especially in national contexts where reporting may be incomplete, inconsistent or politically influenced (Handoyo 2024). Countries with more effective legal enforcement, greater institutional stability, and inclusive political systems are better positioned to implement ESG-aligned policies and deliver outcomes such as emissions reduction, improved education and health access and strengthened public accountability (Liu et al. 2025).

Moreover, ESG outcomes are not only shaped by domestic institutions but also by the broader socioeconomic context in which they operate. National income levels, human development conditions and macroeconomic performance all influence a country's capacity to deliver on ESG targets. Likewise, active engagement in international cooperation (IC) and multilateral frameworks enhances a country's exposure to global norms, technical assistance and external accountability mechanisms, factors that can reinforce ESG-aligned reforms.

Taken together, this approach offers a more holistic framework for assessing ESG at the macro level, moving beyond narrow disclosure metrics to capture the structural, institutional, and developmental conditions that drive sustainability outcomes. By focusing on these deeper foundations, the analysis provides a more meaningful basis for understanding how ESG performance supports or constrains progress towards the 2030 Agenda for Sustainable Development.

4 | Data and Variables

We use biennial data from 2008 to 2022 from 123 countries due to data availability constraints. Our main contribution to the literature is the use of two novel composite ESG performance indices as dependent variables. To construct these variables, we converted SDG scores reported by Sachs et al. (2024) into corresponding ESG scores using the harmonisation approach suggested by Lukács and Rickards (2023). As shown in Table 1, we map SDG categories onto the ESG pillars. Figure 1 presents this harmonisation using two methodologies, namely one based directly on GRI and another on S&P Global's interpretation of GRI, showing which SDGs are associated

TABLE 1 | SDG harmonization to ESG.

	Corresponding SDG		
Panel A. Methodology	**Environmental**	**Social**	**Governance**
GRI	3, 6, 7, 8, 11, 12, 13, 14, 15,16	1, 2, 3, 4, 5, 8, 10, 12, 16	1, 3, 5, 8, 9, 10, 11, 13, 16, 17
S&P global	3, 6, 7, 8, 11, 12, 13, 14, 15	2, 3, 4, 5, 8, 10, 16	1, 8, 9, 10, 16, 17
Panel B. Bartlett's sphericity test		Panel C. KMO scores	
Dimensions	χ^2statistic [p value]	Dimensions	KMO score
Environmental	798.53 [0.0000]***	Environmental	0.846
Social	1297.67 [0.0000]***	Social	0.882
Governance	1262.42 [0.0000]***	Governance	0.861

Note: '[]' shows p values.
***1% significance level.
Source: Lukács and Rickards (2023, 196).

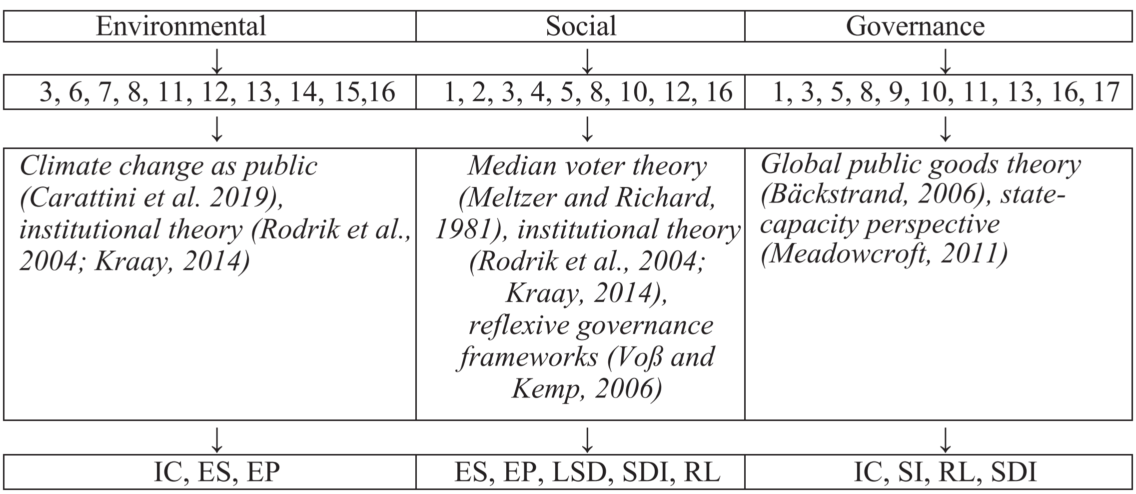

FIGURE 1 | Variable selection through SDG-ESG mapping and theories.

with each ESG pillar under both approaches. After mapping the SDG indicators onto the ESG framework, we constructed two composite ESG indices—ESG_sp and ESG_gri—through principal component analysis (PCA). Prior to applying PCA, we evaluated the suitability of the data using two standard diagnostic tools: the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. As reported in Panels B and C, the KMO values for the environmental (0.846), social (0.882) and governance (0.861) dimensions exceeded the commonly accepted threshold of 0.80, indicating excellent sampling adequacy. In addition, Bartlett's test statistics were highly significant for all dimensions (p value < 0.01), confirming that the correlation matrices are not identity matrices. Together, these results validate the dimensional structure of the underlying indicators and justify the application of PCA in constructing the composite ESG indices. This approach allows for a data-driven yet conceptually coherent aggregation of ESG-related performance measures.

An alternative approach has been proposed by Wang et al. (2023) who calculate country sustainability scores using a weighted average of the relevant sustainability indicators. Their weights are based on the materiality of the indicator in relation to the SDGs, its relevance to the targeted performance dimension, and the country's exposure to the underlying issue. We chose not to adopt this approach due to the subjective nature of the weighting scheme. Instead, by combining the individual ESG data using Principal Components Analysis, we obtained two distinct ESG indicators ESG_S&P and ESG_GRI, respectively, following the S&P Global and Global Reporting Initiative methodologies (see Lukács and Rickards 2023).

The selection of explanatory variables in this study is grounded in both theoretical and policy-based reasoning, reflecting the multidimensional nature of ESG performance at the country level. The SDGs explicitly frame sustainability as a tripartite pursuit of environmental stewardship, social inclusion, and accountable governance, an approach that mirrors the structure of ESG principles. Accordingly, this analysis draws on variables that capture the institutional, developmental, and global engagement dimensions most relevant to national sustainability outcomes following the earlier studies (see Olaniyi et al. 2025). We also include variables represent structural enablers and contextual conditions that shape a country's capacity and willingness to pursue ESG-aligned outcomes. Together, these variables offer a comprehensive view of the structural conditions shaping ESG performance at the macro level (see Zhong et al. 2025; Pan et al. 2025).

The variable selection framework can conceptually be represented as a three-layer process through which we synthesize the existing theories and establish their respective relevance for country-level ESG performance, with a view to building the conceptual foundations of our empirical study. In our conceptual framework, country-level ESG performance is treated as the composite outcome of these interacting mechanisms, which is also aligned with the official framework (see United Nations 2015). More precisely, higher levels of socioeconomic development and more advanced economic structures are expected to expand the fiscal, technological and administrative resources available for environmental protection and social investment. Furthermore, governance-for-SDGs research and the SDG 16 agenda emphasise that the rule of law (RL), democratic quality and institutional stability are foundational for translating these resources into effective and equitable sustainability policies, by ensuring enforcement, accountability and policy continuity. Finally, the SDG 17 literature on global partnerships stresses that IC provides additional finance, technology and capacity-building necessary to implement the SDGs, especially in developing and institutionally fragile contexts.

Accordingly, at the base of our conceptual framework are structural development capacities, which determine the resources and capabilities available to implement sustainability policies. Grounded in institutional theory and increasingly adopted within the sustainability and environmental governance literature (Feindt and Weiland 2018), reflexive governance frameworks emphasize that the ongoing monitoring of performance and the institutionalization of learning-oriented mechanisms are essential for steering societal transformation (Voß and Kemp 2006). From a state-capacity perspective, this requires not only analytical and monitoring capabilities, but also coordinative, regulatory and participatory capacities that enable governments to evaluate policy outcomes, adjust strategies and incorporate feedback into decision-making (Meadowcroft 2011).

In the intermediate layer are domestic governance institutions, which shape how these resources are translated into environmental and social outcomes (Glass and Newig 2019). The broader institutional theory literature underscores the importance of this layer for development outcomes across social and environmental domains (Rodrik et al. 2004; Kraay 2014). Empirical research grounded in these theoretical perspectives generally finds that democracy and civil liberties yield superior development outcomes. Furthermore, median voter theory (Meltzer and Richard 1981) posits that democratic institutions produce more egalitarian socio-economic outcomes. Sen's capability-based development theory further reinforces this logic. Applied to sustainable development, this theoretical lens suggests that democratic decision-making facilitates societal deliberation over fundamental values and long-term collective choices (Glass and Newig 2019; Norris 2012; Siegle et al. 2004; Sen 1999).

Finally, international embeddedness modifies both layers by providing external resources, norms and accountability. In a noteworthy review of the relevant theories, Carattini et al. (2019) highlight the public good properties of climate change mitigation and the lack of a supranational institution for enforcing global treaties. Indeed, the role of international embeddedness in shaping national sustainability outcomes is particularly well established in the global public goods literature (see Kaul et al. 1999; Ostrom 2000). Conceptually, the core components of sustainable development, such as climate stability, biodiversity preservation and financial stability, constitute global public goods that no single country can secure independently. Because these goods are transboundary in nature, their provision requires collective action, international coordination and the pooling of financial and technological resources. Within this framework, a country's degree of IC influences both its structural development capacity and the effectiveness of its domestic institutions. Bäckstrand (2006) demonstrates that multi-stakeholder partnerships are most effective when anchored in international institutional environments that facilitate learning, resource mobilization, and cross-border coordination. In this sense, international embeddedness enhances the value of SDG partnerships by connecting local actors to global knowledge networks, financial mechanisms, and monitoring systems, thereby strengthening their ability to co-produce solutions and to scale successful initiatives across borders.

In light of these conceptual considerations, each variable in our empirical model is chosen as an operational proxy for one of these theoretically motivated constructs, and the model specifications are structured so that overlapping proxies for the same conceptual layer are not combined mechanically but introduced in alternative specifications. This ensures that the empirical analysis faithfully reflects the underlying theoretical framework and that the determinants of ESG performance are interpreted as manifestations of these deeper structural, institutional and international conditions, rather than as a collection of loosely motivated controls. To begin with, institutional characteristics are central in shaping ESG outcomes, particularly democracy status (SI), RL, and the stability of democratic institutions (SDIs). Democratic societies tend to promote civic participation, transparency, and inclusive governance, all of which foster public demand for social equity and environmental protection. A strong RL ensures that environmental and social regulations are enforced fairly and consistently, enhancing institutional credibility and compliance. Furthermore, stable democratic institutions reduce policy volatility, supporting the continuity of long-term sustainability commitments and minimizing governance-related risks that could derail ESG progress (Martiny et al. 2024).

We complemented these institutional foundations by structural and developmental variables such as the level of socioeconomic development (LSD), economy status (ES), economic performance (EP) and IC. Countries with higher socioeconomic development typically have stronger infrastructure, better education and health systems, and more institutional capacity. These structural advantages enable governments to invest in environmental protection, implement social policies, and maintain effective governance systems (Martiny et al. 2024). Development also enhances technological readiness and administrative capacity, which are crucial for meeting ESG targets such as emissions reduction, social equity and regulatory transparency.

On the other hand, high-income countries tend to have greater fiscal space, stronger regulatory institutions, and higher levels of investor scrutiny, all of which support more ambitious ESG agendas. In contrast, low-income economies may face competing developmental priorities, such as poverty reduction or basic infrastructure that constrain their ESG capacity (Martiny et al. 2024). Finally, global environmental and social challenges require collective action. Countries engaged in IC, through climate accords, development partnerships and multilateral institutions, are more likely to align with global ESG norms and benefit from external expertise, funding and accountability mechanisms. International engagement also encourages policy harmonization and facilitates learning from global best practices. This view is broadly supported by the earlier studies.

This three-layer structure (structural development capacity, domestic institutions, international embeddedness) results in a three-step framework linking SDG domains to ESG dimensions and to the theoretical foundations that justify specific variable choice as summarized in Table 1. First, each ESG pillar is mapped to the relevant SDGs. Second, each ESG pillar is anchored in distinct theoretical frameworks. Environmental predictors are justified by climate-related public goods theory and institutional theory emphasising how national capabilities shape environmental outcomes. Social variables are linked to median voter theory, institutional theory and reflexive governance approaches that underscore accountability, participation, and adaptive policymaking. Governance variables draw on global public goods theory and state-capacity perspectives that highlight the role of capable, legitimate institutions in delivering sustainable development. Third, these theoretical lenses translate into specific empirical variables. Environmental mechanisms point towards indicators such as institutional capacity, environmental stringency and environmental performance. Social mechanisms justify the inclusion of environmental stringency, environmental performance, levels of socioeconomic development, sustainable development indices and RL. Governance mechanisms support variables such as institutional capacity, state integrity, RL, and sustainable development indices. Taken together, the chosen predictors operationalise a structured causal narrative in which structural development provides the material and human resources for ESG-aligned policies, domestic institutions determine how effectively those resources are mobilised, and IC modifies both through external support and normative pressure.

For consistency, all variables were obtained from the Bertelsmann Transformation Index (BTI) dataset available at https://bti-project.org, which is a global research initiative that assesses and ranks the quality of democracy, market economy and governance in developing and transition countries. Descriptive statistics are shown in Table 2.

The general model, which includes all variables, is specified as follows:

$$\text{ESG performance(s)}_{\text{it}} = \alpha_{0,1} + \beta_1\text{LSD}_{\text{it}} + \beta_2\text{EP}_{\text{it}} + \beta_3\text{IC}_{\text{it}} + \epsilon_{1i}$$

$$\text{ESG performance(s)}_{\text{it}} = \alpha_{0,2} + \beta_4\text{RL}_{\text{it}} + \beta_5\text{LS}_{\text{it}} + \beta_6\text{EP}_{\text{it}} + \epsilon_{2\text{i}}$$

$$\text{ESG performance(s)}_{\text{it}} = \alpha_{0,3} + \beta_7\text{LSD}_{\text{it}} + \beta_8\text{ES}_{\text{it}} + \beta_9\text{SI}_{\text{it}} + \epsilon_{3\text{i}}$$

$$\text{ESG performance(s)}_{\text{it}} = \alpha_{0,4} + \beta_{10}\text{SI}_{\text{it}} + \beta_{11}\text{LSD}_{\text{it}} + \beta_{12}\text{EP}_{\text{it}} + \varepsilon_{4\text{i}}$$

$$\text{ESG performance(s)}_{\text{it}} = \alpha_{0,5} + \beta_{13}\text{SDI}_{\text{it}} + \beta_{14}\text{LSD}_{\text{it}} + \beta_{15}\text{EP}_{\text{it}} + \epsilon_{5\text{i}}$$

where $\epsilon_{1i}, \ldots, \epsilon_{5i}$ are the erorr terms and i and t refer to country and time dimensions (N and T), respectively. In line with the theoretical framework and relevant literature, the primary hypotheses write in this study are as follows:

H1. *Democracy status (SI) has a positive and statistically significant effect on ESG scores.*

H2. *Stability of democratic institutions (SDI) has a positive and statistically significant effect on ESG scores.*

TABLE 2 | Summary statistics.

Variables	Mean	Std. dev.	Median	Min.	Max.	Skewness	Kurtosis	W statistic	JB statistic
ESG_S&P	−0.3116	1.4286	−0.1542	−3.7662	2.6853	−0.2045	2.2478	0.98***	34.39***
ESG_GRI	−0.3398	1.4483	−0.1443	−3.6455	2.6355	−0.1926	2.1147	0.97***	43.93***
SI	5.7098	2.0439	5.85	1.2667	9.95	0.1321	2.0386	0.97***	45.42***
RL	5.1284	2.1038	5.00	1.00	10	0.3074	2.4163	0.98***	32.89***
SDI	5.0114	2.8607	5.50	1.00	10	0.1137	1.5716	0.94***	95.38***
LSD	4.3614	2.3146	4.00	1.00	10	0.3621	2.3779	0.99***	41.70***
ES	5.6467	1.7551	5.6071	1.1429	9.7857	0.0474	2.6791	0.99***	5.223*
EP	6.2232	1.8575	6.00	1.00	10	−0.5156	3.3413	0.98***	53.06***
IC	6.7699	1.8723	7.00	1.00	10	−0.5519	3.0152	0.98***	55.45***

***,
**and
*show 1%, 5% and 10% significance levels, respectively.

H3. *LSD has a positive and statistically significant effect on ESG scores.*

H4. *EP has a positive and statistically significant effect on ESG scores.*

H5. *ES has a positive and statistically significant effect on ESG scores.*

H6. *IC has a positive and statistically significant effect on ESG scores.*

H7. *RL has a positive and statistically significant effect on ESG scores.*

These hypotheses were drawn from the recent literature (see Pickering et al. 2022; Martiny et al. 2024; Leung and Ko 2025; Atta et al. 2024; Krambia-Kapardis et al. 2023; Lin et al. 2025). While the general hypotheses of this study establish the expected positive influence of institutional, law and economic factors on ESG performance, relying solely on conditional mean estimators may obscure how these effects vary across the ESG distribution.

To address this issue, we adopt the method of moments panel quantile regression, which allows for a more nuanced understanding of the relationship between independent variables and ESG scores at various quantiles. This approach enables the formulation of extended hypotheses that capture potential distributional heterogeneities, reflecting, for instance, whether certain variables exert stronger or weaker effects at lower or upper ESG scores levels. The following quantile-specific hypotheses are therefore proposed to further refine and contextualize the general expectations of the study:

H01. *The effect of LSD on ESG scores is constant across the distribution.*

H02. *The effect of IC on ESG scores is constant across the distribution.*

H03. *The effect of EP on ESG scores is constant across the distribution.*

H04. *The effect of ES on ESG scores is constant across the distribution.*

H05. *The effect of RL on ESG scores is constant across the distribution.*

H06. *The effect of democracy status (SI) on ESG scores is constant across the distribution.*

H07. *The effect of the stability of democratic institutions (SDI) on ESG scores is constant across the distribution.*

Potential high dependencies among independent variables raise concerns about multicollinearity, which may weaken the reliability of regression coefficient estimates, as it violates a fundamental assumption of regression analysis. To identify the direction and power of these relationships and to support model specification, a pairwise correlation matrix is shown in Table 3. The correlation coefficient between the two dependent variables, ESG_S&P and ESG_GRI, is 0.9952. This extremely high degree of association indicates that the two indicators capture virtually identical underlying ESG structures, with only minor differences in measurement or scale.

Highest correlation coefficients are observed between SI and RL (0.97), SI and SDI (0.97), RL and SDI (0.91), RL and IC (0.81), ES and LSD (0.88), ES and EP (0.80), and IC and SI (0.80), respectively. This suggests that their simultaneous inclusion in regression models could lead to inflated standard errors and reduced interpretability of individual parameter estimates. Hence, these findings directly informed the specification of alternative models designed to avoid multicollinearity.

In addition to the pairwise correlation coefficients, partial correlation diagnostics were also employed to assess the independent contribution of each independent variable to the ESG scores, after controlling for the influence of all other predictors in the model. As can be seen in Table 4, for ESG_GRI, among all variables, LSD exhibited the highest partial correlation coefficient of 0.4750, corresponding to a partial R^2 of 0.2256. This indicates that LSD alone accounts for approximately 22.6% of the variance in ESG_GRI, net of all other variables. ES and EP followed with lower but still meaningful partial R^2 values of 0.0903 and 0.0551, respectively.

A remarkably similar pattern is observed for ESG_S&P, where LSD again presents the highest partial correlation 0.4532 and partial R^2 as 0.2054. As shown in Table 5, ES and EP contribute with partial R^2 values of 0.0743 and 0.0517, respectively. Although RL and IC are statistically significant in both models, their squared partial contributions remain modest. On the other hand, SDI yields lower explanatory power in both structures. These findings, consistent across both ESG measures, underscore the foundational role of LSD as a structural determinant of ESG scores. The high partial explanatory power of LSD, alongside its theoretical significance in capturing socioeconomic development, verifies its inclusion in all model specifications.

To ensure the robustness of the findings derived from partial correlation analysis and to evaluate the individual explanatory contributions of the independent variables, the stepwise regression procedure was employed and the findings are summarised in Table 6. For validation purposes, the dataset was randomly

TABLE 3 | Correlation matrix (standard correlation coefficients).

Variables	ESG_S&P	ESG_GRI	SI	RL	SDI	LSD	ES	EP	IC
ESG_S&P	1	1							
ESG_GRI	0.9952***								
SI	[0.0000]	0.4838***	1						
	0.4957***								
RL	[0.0000]	[0.0000]	0.9663***	1					
	0.5293***	0.5218***							
SDI	[0.0000]	[0.0000]	[0.0000]	0.9144***	1				
	0.3810***	0.3694***	0.9654***						
LSD	[0.0000]	[0.0000]	[0.0000]	[0.0000]	0.4187***	1			
	0.8785***	0.8897***	0.5418***	0.5940***					
ES	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	0.8816***	1		
	0.8065***	0.8118***	0.7420***	0.7823***	0.6256***				
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]			
EP	0.5426***	0.5494***	0.5001***	0.5295***	0.4099***	0.6392***	0.7958***	1	
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]		
IC	0.4419***	0.4332***	0.7983***	0.8121***	0.7487***	0.4854***	0.7483***	0.6212***	1
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	

Note: '[]' shows *p* values.
***1% significance level.

TABLE 4 | Partial correlation coefficients for ESG_S&P.

Dependent variable: ESG_S&P					
Variables	**Partial corr.**	**Semipartial corr.**	**Squared partial corr.**	**Squared semipartial corr.**	***p***
SI	0.0750**	0.0341	0.0056	0.0012	0.0134
RL	−0.1454***	−0.0666	0.0211	0.0044	0.0000
SDI	−0.0285	−0.0129	0.0008	0.0002	0.3485
LSD	0.4532***	0.2305	0.2054	0.0531	0.0000
ES	0.2726***	0.1285	0.0743	0.0165	0.0000
EP	−0.2274***	−0.1059	0.0517	0.0112	0.0000
IC	−0.0587*	−0.0267	0.0034	0.0007	0.0532

***,
**and
*show 1%, 5% and 10% significance levels, respectively.

divided into two subsets as 80% for training and 20% for testing. This partition enabled the assessment of model generalizability and allowed for an isolated examination of how each explanatory variable contributes to the variation in the dependent constructs.

Furthermore, the ΔR^2 values presented in Figure 2 illustrate the explanatory power of each independent variable on ESG_GRI and ESG_S&P scores. LSD and ES stand out as the strongest predictors, achieving the highest levels of explained variance. EP and RL make moderate contributions, while SI, INC, and SDI have more limited explanatory capacity. Figure 2 illustrates the comparative shares of explained variance (ΔR^2) across the independent variables. These results are largely consistent with those obtained from the partial correlation analysis.

Despite the strong explanatory role of ES, its very high correlation with other explanatory variables increases the risk of

TABLE 5 | Partial correlation coefficients for ESG_GRI.

Dependent variable: ESG_GRI					
Variables	**Partial corr.**	**Semipartial corr.**	**Squared partial corr.**	**Squared semipartial corr.**	***p***
SI	0.0319	0.0138	0.0010	0.0002	0.2938
RL	−0.1284***	−0.0559	0.0165	0.0031	0.0000
SDI	0.0029	0.0012	0.0000	0.0000	0.9242
LSD	0.4750***	0.2332	0.2256	0.0544	0.0000
ES	0.3006***	0.1362	0.0903	0.0185	0.0000
EP	−0.2347***	−0.1043	0.0551	0.0109	0.0000
IC	−0.0793***	−0.0344	0.0063	0.0012	0.0089

***shows 1% significance level.

TABLE 6 | Ranking of independent variables based on stepwise entry order.

	Dependent variable: ESG_GRI			Dependent variable: ESG_S&P		
Variables	**Entry order**	**ΔR^2**	***p***	**Entry order**	**ΔR^2**	***p***
SI	5	0.2341***	0.0000	5	0.2459***	0.0000
RL	4	0.2723***	0.0000	4	0.2803***	0.0000
SDI	7	0.1364***	0.0000	7	0.1451***	0.0000
LSD	1	0.7918***	0.0000	1	0.7722***	0.0000
ES	2	0.6598***	0.0000	2	0.6512***	0.0000
EP	3	0.3021***	0.0000	3	0.2948***	0.0000
IC	6	0.1877***	0.0000	6	0.1953***	0.0000

***shows 1% significance level.

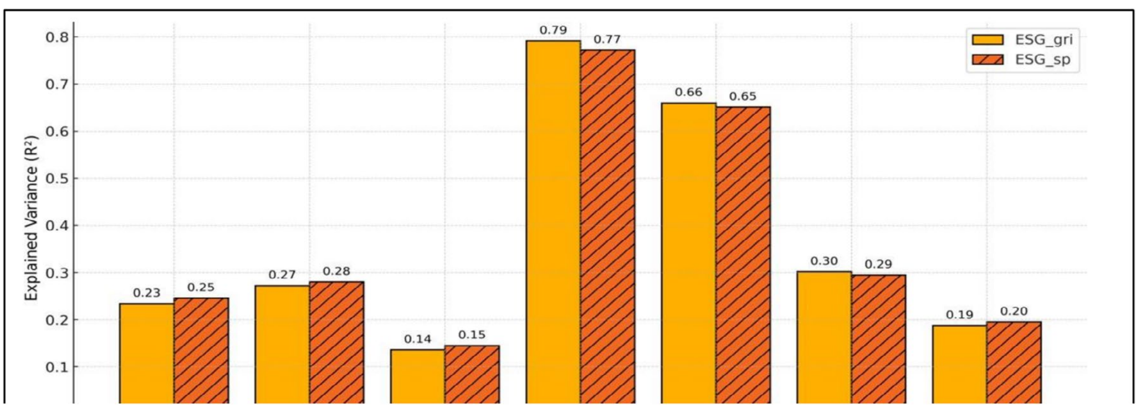

FIGURE 2 | Bar plot for Stepwise metric.

multicollinearity. As a result, instead of including ES directly in the models, EP, which is highly correlated with ES and considered a reasonable substitute both statistically and theoretically, has been preferred.

5 | Methodology and Empirical Findings

Prior to proceeding with panel data regression estimation, it is critical to determine whether the model parameters vary across individual and/or over time. The process of testing for individual and/or time effects proceeds in three stages. In the first stage, a joint *F* test is conducted to assess the simultaneous presence of both individual and time effects. The null hypothesis states that neither individual nor time effects exist, whereas the alternative hypothesis posits the existence of both effects. In the second stage, individual effects are tested individually. Here, the null hypothesis assumes the absence of individual-specific effects, while the alternative hypothesis suggests that individual effects are present. In the third stage, time effects are examined separately, with the null hypothesis indicating no time effects and the alternative hypothesis asserting their presence. Finally, in the joint test for both effects, the hypotheses are formalized as no individual or time effects exist, and alternative both individual and time effects are present.

The results of both the *F* test and the likelihood ratio (LR) test for the ESG_S&P and ESG_GRI model specifications, respectively, in Tables 7 and 8, provide strong evidence, at the 1% significance level, supporting the joint presence of individual and time effects. Due to the non-normal distributional characteristics of the ESG scores series and the presence of individual and time heterogeneity and asymmetry, we opt for method of moments panel quantile regression (MMQR) proposed by Machado and Silva (2019). This approach allows for the estimation of heterogeneous effects across the conditional distribution of the dependent variable (quantiles) and offers a distributionally estimate into ESG scores' heterogenous behaviour.

The results for Model I to Model V are documented on Tables 9–13. As can be seen from the results, LSD and ES stand out as the most consistent and statistically significant determinants of ESG_GRI and ESG_S&P across all models. Findings from Models I and II confirm their suitability as dependable predictors of ESG scores. RL and IC yield statistically significant coefficients in Models II and III, indicating moderate yet

TABLE 7 | Summary of *F* tests results.

Panel A. ESG_S&P models	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
Type of *F* tests	***F* statistic**	***F* statistic**	***F* statistic**	***F* statistic**	***F* statistic**
Individual and time effects	204.40***	204.39***	207.44***	204.87***	201.70***
Individual effects	187.82***	187.75***	189.33***	187.90***	185.41***
Time effects	347.86***	339.85***	369.27***	346.77***	339.37***
Panel B. ESG_GRI models	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
Type of *F* tests	***F* statistic**	***F* statistic**	***F* statistic**	***F* statistic**	***F* statistic**
Individual and time effects	237.25***	237.06***	237.93***	237.80***	234.55***
Individual effects	221.41***	221.56***	221.09***	221.87***	219.20***
Time effects	344.29***	337.10***	359.47***	343.18***	337.60***

***1% significance level.

TABLE 8 | Summary of LR tests results.

Panel A. ESG_S&P models	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
Type of LR tests	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**
Individual and time effects	2667.73***	2671.63***	2693.30***	2671.98***	2656.91***
Individual effects	1393.01***	1406.35***	1364.03***	1395.18***	1398.91***
Time effects	118.82***	119.36***	126.32***	120.63***	118.59***
Panel B. ESG_GRI models	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
Type of LR tests	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**	**χ^2 statistic**
Individual and time effects	2793.50***	2796.20***	2806.25***	2797.52***	2784.42***
Individual effects	1528.31***	1539.98***	1500.39***	1531.12***	1532.38***
Time effects	104.32***	103.06***	109.26***	104.54***	103.07***

***1% significance level.

TABLE 9 | Method of moments quantile regression estimation results for Model I.

	Dependent variable: ESG_GRI Grid of quantiles					Dependent variable: ESG_S&P grid Grid of quantiles				
Regressors	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
LSD coefficient	0.0555***	0.0571***	0.0595***	0.0621*	0.0638***	0.0529***	0.0569***	0.0636***	0.0702***	0.0746***
Robust std. error	0.0120	0.0105	0.0094	0.0100	0.0114	0.0131	0.0115	0.0101	0.0105	0.0119
EP coefficient	0.0362***	0.0348***	0.0328***	0.0307***	0.0293***	0.0370***	0.0353***	0.0326***	0.0299***	0.0281***
Robust std. error	0.0051	0.0046	0.0046	0.0055	0.0065	0.0057	0.0052	0.0050	0.0059	0.0068
IC coefficient	0.0173***	0.0177***	0.0184***	0.0191***	0.0195***	0.0245***	0.0241***	0.0233***	0.0226***	0.0221***
Robust std. error	0.0065	0.0058	0.0054	0.0061	0.0071	0.0074	0.0066	0.0062	0.0068	0.0078

Note: The MMQR models include constant, location and scale parameters and individual and time effects; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 10 | Method of moments quantile regression estimation results for Model II.

	Dependent variable: ESG_GRI Grid of quantiles					Dependent variable: ESG_S&P Grid of quantiles				
Regressors	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
RL coefficient	0.0227**	0.0227***	0.0226***	0.0225***	0.0225***	0.0299***	0.0291***	0.0277***	0.0263***	0.0254***
Robust std. error	0.0094	0.0083	0.0074	0.0077	0.0086	0.0107	0.0095	0.0082	0.0085	0.0094
LSD coefficient	0.0517***	0.0535***	0.0564***	0.0594***	0.0615***	0.0489***	0.0528***	0.0600***	0.0669***	0.0714***
Robust std. error	0.0127	0.0111	0.0098	0.0102	0.0116	0.0137	0.0121	0.0105	0.0109	0.0122
EP coefficient	0.0378***	0.0364***	0.0342***	0.0320***	0.0305***	0.0389***	0.0373***	0.0345***	0.0317***	0.0298***
Robust std. error	0.0051	0.0046	0.0045	0.0053	0.0063	0.0057	0.0052	0.0050	0.0058	0.0067

Note: The MMQR models include constant location and scale parameters and individual and time effects; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 11 | Method of moments quantile regression estimation results for Model III.

	Dependent variable: ESG_GRI					Dependent variable: ESG_S&P				
	Grid of quantiles					Grid of quantiles				
Regressors	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
LSD coefficient	0.0243**	0.0240**	0.0234**	0.0228**	0.0225*	0.0169	0.0192*	0.0235**	0.0276**	0.0301**
Robust std. error	0.0124	0.011	0.0099	0.0106	0.0119	0.0133	0.012	0.0109	0.0116	0.0129
ES coefficient	0.1040***	0.1104***	0.1213***	0.1313***	0.1381***	0.1142***	0.1194***	0.1294***	0.1388***	0.1445***
Robust std. error	0.0201	0.0175	0.0152	0.0157	0.0174	0.0224	0.0199	0.0170	0.0173	0.0189
SI coefficient	0.0101	0.0079	0.0041	0.0006	0.0018	0.0157	0.0131	0.0082	0.0036	0.0007
Robust std. error	0.0162	0.0137	0.0104	0.0091	0.0095	0.0181	0.0156	0.0119	0.0101	0.0104

Note: The MMQR models include constant, location and scale parameters and individual and time effects; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 12 | Method of moments quantile regression estimation results for Model IV.

	Dependent variable: ESG_GRI					Dependent variable: ESG_S&P				
	Grid of quantiles					Grid of quantiles				
Regressors	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
SI coefficient	0.0281**	0.0276**	0.0267***	0.0259***	0.0253**	0.0380***	0.0362***	0.0330***	0.0297***	0.0277**
Robust std. error	0.0127	0.0111	0.0093	0.0092	0.0101	0.0142	0.0125	0.0105	0.0102	0.0110
LSD coefficient	0.0511***	0.0528***	0.0556***	0.0584***	0.0603***	0.0478***	0.0518***	0.0588***	0.0659***	0.0703***
Robust std. error	0.0132	0.0115	0.0099	0.0102	0.0115	0.0141	0.0125	0.0107	0.0110	0.0122
EP coefficient	0.0364***	0.0354***	0.0337***	0.0320***	0.0309***	0.0372***	0.0360***	0.0339***	0.0317***	0.0304***
Robust std. error	0.0052	0.0047	0.0046	0.0053	0.0063	0.0057	0.0052	0.0050	0.0058	0.0067

Note: The MMQR models include constant, location and scale parameters; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 13 | Method of moments quantile regression estimation results for Model V.

	Dependent variable: ESG_GRI					Dependent variable: ESG_S&P				
	Grid of quantiles					Grid of quantiles				
Regressors	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
SDI coefficient	0.0294***	0.0182**	−0.0007	−0.0154*	−0.0278***	0.0523***	0.0343***	0.0100	−0.0128	−0.0304
Robust std. error	0.0084	0.0075	0.0071	0.0082	0.0097	0.0092	0.0080	0.0075	0.0085	0.0102
LSD coefficient	0.5846***	0.5709***	0.5479***	0.5299***	0.5148***	0.5487***	0.5400***	0.5281***	0.5171***	0.5085***
Robust std. error	0.0138	0.0116	0.0092	0.0094	0.0112	0.0143	0.0117	0.0097	0.0104	0.0124
EP coefficient	0.0436**	0.0327**	0.0143	−0.0001	−0.0122	0.0567***	0.0394**	0.0158	−0.0062	−0.0232
Robust std. error	0.0192	0.0165	0.0141	0.0151	0.0177	0.0209	0.0176	0.0150	0.0160	0.0187

Note: The MMQR models include constant, location and scale parameters and individual and time effects; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

meaningful contributions. In contrast, SI and SDI appear with smaller coefficients and limited significance, suggesting that democratic dimensions have a more marginal influence on ESG evaluations.

The results of Model III indicate that ES has the highest coefficient estimates among all variables (and models). The impact of ES becomes particularly pronounced at the median and upper quantiles (0.50, 0.75 and 0.90) for both ESG_GRI and ESG_S&P. While LSD continues to exert a strong effect in this model, its magnitude is surpassed by that of ES. Although the SI variable yields positive coefficient estimates, these are not statistically significant. Model IV confirms the persistent positive influence of LSD, consistent with the results from Models I, II, and III. Additionally, SI and EP also demonstrate positive and statistically significant effects in this model. SI appears especially prominent in relation to ESG_S&P scores, where its coefficient estimates are comparatively higher. Finally, in Model V, SDI is statistically significant only at the lower quantiles of ESG_GRI and that its coefficients remain relatively small. In addition, EP shows significance at selected quantiles, while LSD continues to deliver strong and statistically significant effects across the entire quantiles.

Next, two-way FE and RE models were employed to estimate the same specifications for ESG_S&P and ESG_GRI as a test for robustness. Findings generally demonstrate statistically significant results, and the time dummies included in these models are also statistically significant, further supporting the earlier findings regarding the presence of individual and time effects, as revealed by the F and LR tests. In all estimated fixed effects and random effects models, evidence of heteroskedasticity, serial correlation, and cross-sectional dependence was identified. In response, the Driscoll and Kraay (1998) standard errors were employed as they provide robust inference in the presence of such violations.

As can be seen from Table 14, for the FE models, the R^2 values are approximately 0.75, and the associated F statistics confirm the overall statistical significance of the models. All independent variables, with the exception of SDI, are found to be statistically significant and positively associated with ESG_GRI. The Wald statistics confirm the overall statistical significance of the models, while the R^2 values range between approximately 0.67 and 0.68. Among the independent variables, ES and LSD consistently emerge as the most influential factors, exhibiting the highest coefficient estimates across specifications.

These combine results highlight the dominant role of economic fundamentals and development levels in shaping countries' ESG performance under the random/fixed effects framework. Although SDI yields a coefficient consistent with theoretical expectations, the lack of statistical significance limits its explanatory power. Among the predictors, the highest coefficient estimates belong to LSD and ES. In the long run, LSD, EP, ES, RL, IC and SI impact a positive influence on ESG_GRI scores. Turning to the FE estimation results for ESG_S&P, the models again exhibit statistical significance, as indicated by F statistics and R^2 values near 0.75. As shown in Table 15, all variables produce positive coefficient estimates, mirroring the pattern observed in the ESG_GRI model. However, SI and SDI are not statistically significant in this specification. As with the previous

TABLE 14 | Summary of FE regression estimation results.

Regressors		Panel A. Dependent variable: ESG_S&P					Panel B. Dependent variable: ESG_GRI				
		Model I	**Model II**	**Model III**	**Model IV**	**Model V**	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
SI	Coefficient			0.0083	0.0330***				0.0042	0.0267***	
	DK std. error			0.0122	0.0083				0.0104	0.0075	
RL	Coefficient		0.0277***					0.0226***			
	DK std. error		0.0057					0.0049			
SDI	Coefficient					0.0047					0.0027
	DK std. error					0.0053					0.0043
LSD	Coefficient	0.0636***	0.0599***	0.0234***	0.0588***	**0.0652*****	0.0596***	0.0564***	0.0234***	0.0556***	**0.0610*****
	DK std. error	0.0091	0.0089	0.0041	0.0088	0.0090	0.0080	0.0078	0.0038	0.0075	0.0083
ES	Coefficient			**0.1292*****					**0.1208*****		
	DK std. error			0.0277					0.0217		
EP	Coefficient	0.0326***	0.0345***		0.0339***	0.0360***	0.0328***	0.0342***		0.0337***	0.0356***
	DK std. error	0.0053	0.0061		0.0064	0.0061	0.0042	0.0050		0.0053	0.0048
IC	Coefficient	0.0233***					0.0184***				
	DK std. error	0.0040					0.0040				
	Model information										
	R^2	0.7504	0.7511	0.7577	0.7496	0.7461	0.7469	0.7462	0.7534	0.7466	0.7436
	F statistic	4 027 728.11***	5 666 370.53***	669 623.34***	1 618 834.92***	1 530 904 0.82***	3 023 323.68***	2 250 174.18***	299 158.14***	852 013.11***	2 655 372.33***
	Model specification tests										
	DeBenedictis–Giles specification RESET L tests										
	Reset L1/F	0.80	1.80	1.83	2.58*	0.53	0.70	1.09	0.74	1.57	1.57
	Reset L2/F	0.78	1.00	0.97	1.40	1.03	0.85	0.77	0.57	1.03	1.03
	Reset L3/F	1.46	1.60	2.71**	1.64	1.24	1.37	1.25	2.25**	1.25	1.25
	DeBenedictis–Giles specification RESET S tests										
	Reset S1/F	0.74	1.46	1.48	2.15	0.83	0.85	1.17	0.91	1.61	1.61
	Reset S2/F	0.95	1.13	1.90	1.39	0.85	0.81	0.75	1.06	0.98	0.98
	Reset S3/F	1.56	1.22	2.26**	1.23	1.30	0.86	0.61	1.17	0.72	0.72

Note: 'DK' is the abbreviation for Driscoll and Kraay (1998) standard errors, which are robust to heteroskedasticity, autocorrelation and cross-sectional dependence. The FE models include a constant and time dummies; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 15 | Summary of RE regression estimation results.

		Panel A. Dependent variable: ESG_S&P					Panel B. Dependent variable: ESG_GRI				
Regressors		**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**	**Model I**	**Model II**	**Model III**	**Model IV**	**Model V**
SI	Coefficient			0.0108	0.0438***				0.0057	0.0358***	
	DK std. error			0.0095	0.0050				0.0089	0.0052	
RL	Coefficient		0.0391***					0.0323***			
	DK std. error		0.0045					0.0044			
SDI	Coefficient					0.0090*					0.0062*
	DK std. error					0.0046					0.0030
LSD	Coefficient	0.1228***	0.1169***	0.0667***	0.1161***	0.1256***	0.1126***	0.1075***	0.0626*	0.1069***	0.1149***
	DK std. error	0.0072	0.0085	0.0119	0.0081	0.0078	0.0051	0.0063	0.0114	0.0061	0.0042
ES	Coefficient			0.1538***					0.1436***		
	DK std. error			0.0369					0.0286		
EP	Coefficient	0.0316***	0.0334***		0.0327***	0.0354***	0.0319***	0.0332***		0.0327***	0.0350***
	DK std. error	0.0086	0.0096		0.0097	0.0097	0.0067	0.0073		0.0075	0.0066
IC	Coefficient	0.0276***					0.0220***				
	DK std. error	0.006					0.0060				
	Model information										
	R2	0.67	0.67	0.67	0.67	0.68	0.6764	0.6764	0.7001	0.7001	0.6796
	Wald statistic	61669.18***	61669.18***	2562884.93***	474113.89***	474113.89***	514801.54***	514801.54***	1575188.90***	1979591.39*	2637350.17***
	Model specification tests										
	DeBenedictis–Giles specification RESET L tests										
	Reset L1/F 2.85*		3.65**	3.34**	4.33** 1.90		1.94	1.79	1.29	2.48	0.79
	Reset L2/F 1.77		2.21*	2.09*	2.43** 1.73		1.40	1.41	1.48	1.61	1.48
	Reset L3/F 2.29**		2.44**	2.98***	2.48** 1.85		1.77	1.65	2.53**	1.71	1.56
	DeBenedictis–Giles specification RESET S tests										
	Reset S1/F 0.09		0.29	0.31	0.53 0.28		0.20	0.29	0.32	0.46	0.50
	Reset S2/F 1.18		1.09	0.75	1.03 0.65		0.37	0.21	0.55	0.29	0.31
	Reset S3/F 0.86		0.83	1.67	0.78 0.55		0.43	0.23	1.15	0.27	0.39

Note: 'DK' is the abbreviation for Driscoll and Kraay (1998) standard errors, which are robust to heteroskedasticity, autocorrelation and cross-sectional dependence. The RE models include a constant and time dummies; however, these components are not reported due to space constraints.
***,
**and
*show 1%, 5% and 10% significance levels, respectively.

TABLE 16 | VIF criteria.

Model	LSD	EP	IC	RL	ES	SI	SDI	Mean VIF
Model I	1.73	2.15	1.66					1.85
Model II	2.00	1.80		1.64				1.81
Model III	5.14				8.07	2.55		5.25
Model IV	1.9	1.79				1.50		1.73
Model V	1.78	1.76					1.27	1.60

model, LSD and ES are identified as the most influential factors of ESG performance.

Table 16 presents the Variance Inflation Factor (VIF) values and corresponding tolerance levels (1/VIF) for each explanatory variable across the five model specifications developed in the study. As shown, all VIF values remain well below the commonly accepted threshold of 10, indicating that multicollinearity is not a significant concern in any of the model specifications. Moreover, the mean VIF values, which range between 1.60 and 5.25, further confirm the absence of problematic multicollinearity levels in none of the models. The stepwise and theory-informed specification process applied in this study—whereby highly correlated variables were intentionally not included in the same model—appears to have been effective in mitigating multicollinearity. This approach enabled a cleaner identification strategy and improved the interpretability of the coefficients. Notably, even in Model III, where relatively higher VIF values are observed (e.g., ES), the mean VIF remains below the critical value, and variable inclusion was theoretically justified.

6 | Conclusion and Limitations

6.1 | Conclusion

This paper shifts the ESG performance away from firm-level disclosure and refocuses attention on macro-level performance outcomes, thereby bridging the gap between ESG implementation and sustainable development. By constructing two composite ESG indices using SDG-aligned data and applying MMQR, it uncovers heterogeneous effects of institutional, economic and governance-related drivers across the ESG performance spectrum. Complementary fixed effects and random effects panel models further substantiate the findings.

Our findings lend support to earlier studies on sustainable development (see Singhania et al. 2024). From a policy standpoint, structural and economic fundamentals such as the LSD, EP and ES exert the most profound influence on national ESG performance. This has direct implications for governments seeking to accelerate progress towards the SDGs. Enhancing macroeconomic stability, investing in human development and strengthening legal frameworks are not only ends in themselves but also serve as foundational pillars for achieving specific SDGs.

The statistically significant role of IC also suggests that multilateral engagement and cross-border sustainability efforts such as climate finance, global education partnerships and development aid can meaningfully support ESG alignment, particularly in countries with resource constraints or institutional fragility. These findings underscore the need for coordinated global action to promote policy coherence, resource mobilization and knowledge-sharing across borders.

Furthermore, democratic governance and institutional quality, measured through variables such as rule of law (RL), democracy status (SI) and stability of democratic institutions (SDIs), yield comparatively modest and less consistent effects. While these variables are positively signed and theoretically sound, their statistical significance and effect sizes diminish when controlling for economic and developmental variables. This finding suggests that while institutional quality matters, it may act more as a facilitating condition rather than a direct driver of ESG outcomes, particularly in lower quantiles of the ESG distribution. However, their indirect role, such as reducing policy volatility, improving enforcement and fostering inclusive policymaking, remains critical for achieving SDGs. This assessment is in line with the recent studies (see Olaniyi et al. 2025).

The overarching policy implication is the need for a multidimensional, developmentally anchored ESG strategy. ESG frameworks should no longer be viewed solely as tools for investor signalling or regulatory compliance, but as operational policy instruments for tracking national progress towards the SDGs. National ESG strategies must be anchored in developmental policy frameworks that prioritize equitable growth, education and public health, which are all areas closely tied to the SDGs.

6.2 | Limitations

The main limitation of the current study is the selection of data sources, in particular the use of BTI indexes as the core component of empirical strategies. Although this choice may be seen as a constraint in terms of external validity or reproducibility with alternative data sets, it is crucial to emphasize that the BTI indicators have been selected not only for their operational convenience but also for their conceptual coherence with the theoretical framework adopted in this study. The BTI data sets offer a highly structured and integrated measurement scheme that covers 123 countries and includes the quantitative and qualitative dimensions of governance, institutional quality, and social development- the foundational components of the study. Furthermore, ESG monitoring tools should be integrated into national planning and budgeting processes to ensure that resource allocation is aligned with long-term sustainability outcomes.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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