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Disaggregated ESG Pillars and Firm Value: The Moderating Role of Board Diversity in European Listed Companies

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Abstract

Purpose:

This study examines the individual effects of the Environmental, Social, and Governance (ESG) pillars on firm value and whether board diversity moderates these relationships, addressing inconsistent findings in the ESG–performance literature.

Design/Methodology/Approach:

Using a dynamic panel of European listed companies (2014–2023), the study applies a two-step system Generalized Method of Moments (GMM) estimator to control for endogeneity, unobserved heterogeneity, and performance persistence. Board diversity is measured with a composite index derived via principal component analysis (PCA), and interaction terms test moderating effects.

Findings:

ESG pillars, assessed independently, have no significant direct effect on firm value. However, board diversity significantly moderates the ESG–performance relationship, particularly for the environmental and social pillars. Robustness checks using an alternative Tobin's Q specification confirm the results.

Practical Implications:

ESG initiatives do not enhance performance on their own; they require governance structures capable of interpreting and executing sustainability strategies. Firms and policymakers should therefore prioritize board diversity to strengthen ESG integration.

Theoretical Implications:

The study contributes to stakeholder, agency, and upper echelon theories by showing that the ESG–performance link is contingent on board characteristics, challenging the assumption of universal ESG benefits and supporting a contingency-based perspective.

Originality/Value:

By disaggregating ESG pillars and modelling board diversity as a moderator within a dynamic panel framework, the study clarifies when and how ESG practices influence firm value, and strengthens methodological robustness through GMM estimation and alternative performance measures.

1. Introduction

Corporate governance (CG) has become a fast-growing practice in organizations, and its importance has been recognized worldwide. Organizations are committed to applying mechanisms and principles that correspond to effective monitoring of company activities in the broadest sense. Adoption of these methods is anticipated when environmental, social, and governance (ESG) approaches are implemented, especially when transparency and accountability are embraced (AlQudah et al., 2025; Almnadheh et al., 2025; Grantham, 2020). CG is a well-liked subject in scholarly studies and significantly affects the success of businesses (Samara & Nassar, 2023; Munir et al., 2019). Thus, CG primary objective is to resolve the principal-agent dilemma that the business is facing. It also aims to optimize the business's financial performance and create a long-term, stable structure that promotes balance and collaboration with the top leadership of the business by carefully considering the goals of all parties involved, including the board, owners, managers, and workers (Mohammad et al., 2023). Safeguarding the rights of everyone involved while creating and growing value for investors is an essential component of sound corporate management (Uzliawati et al., 2023).

In 2004, UN Secretary-General Kofi Annan invited financial firms to participate in an international effort under which the word "ESG" was first used. The initiative's goal was to provide guidelines and recommendations for integrating better business ethics and social and environmental concerns into the administration of assets, trading in securities services, and other associated research functions (Wang, 2024). These core ideas address the necessity of incorporating ESG in investment analysis and decision-making procedures, encouraging proactive ownership, integrating ESG factors into ownership policies and procedures, and requiring placed entities to disclose ESG factors in a suitable manner (Thapa, 2024). While investors' decisions about their portfolios are the main focus of ESG, other financial decisions, such as borrowing, financing, and suggestions for investments, should also fall under its purview (Wang, 2024).

The objective of reviewing and assessing the profitability of different organizations and businesses is to provide financial information to all individuals interested in the institution's operations to identify their strengths and weaknesses. Consequently, evaluating the profitability of financial institutions is critical in all societies and systems of economics (Olaniyi et al., 2023). Profitability measures a business's ability to turn a profit, and shows how well its operations work when liquidity, asset management, and debt are all considered. Typically, profitability is expressed as a number between one and three, representing percentages like revenue margins, ROI, and ROE (Almashhadani & Almashhadani, 2022).

Despite the growing academic and policy interest in ESG and firm performance, the literature remains inconclusive regarding the direction and significance of these relationships. Many existing studies either treat ESG as a composite index or emphasize one dimension at the expense of others, thereby overlooking the heterogeneous effects of environmental, social, and governance components. Furthermore, a majority of prior research employs static estimation techniques that do not adequately address endogeneity, unobserved heterogeneity, or the dynamic nature of corporate performance. This methodological limitation potentially undermines the reliability of inferences drawn about ESG's financial implications. This study addresses these gaps by

offering a multidimensional and dynamic investigation into the ESG–performance nexus. Specifically, it disentangles the individual effects of environmental, social, and governance pillars on firm value and explores how board diversity—measured through a composite index derived from Primary Component Analysis—moderates these relationships. The use of a two-step system GMM estimator enhances the methodological rigor by controlling for potential endogeneity and autocorrelation, which are common in corporate panel data. By applying this approach to a panel of European listed companies, the study contributes to both ESG literature and corporate governance theory. It offers empirical insights into the conditions under which ESG activities may enhance firm value and emphasizes the strategic role of board composition in amplifying or mitigating these effects.

The remainder of this paper discusses pertinent literature to establish the mediation relationship. The results section then analyzes the findings and responds to the research question. Additionally, this research offers both mathematical and practical insights.

2. Literature Review

2.1. Theoretical Framework

2.1.1. Agency Theory

Agency theory emphasizes that keeping both control and ownership apart reduces the likelihood of advantageous disputes. The serious conflict involving information asymmetry that corporate governance processes can solve is also highlighted, though. According to Jizi (2017), boards preserve stakeholder benefits while reducing the information asymmetry between management and stakeholders. Some board characteristics help to maximize business resources and promote large-scale sustainable development. As the theoretical foundation of corporate governance, principal-agent theory (Jensen & Meckling, 1976) is regarded as the most important, even though some writers use other theories.

The board of directors and shareholders have a principal-agent relationship, and corporate governance is the process created to address issues that may arise in this dynamic (Aljarrah & Alslaibi, 2025; Kuzey et al., 2023). Agency theory is defined as a contractual arrangement that arises when an owner assigns their work to another individual, the agent, to complete it on their behalf (Mansour et al., 2022). The application of agency theory to business contexts aids in comprehending roles and relationships, particularly accountability (Delbufalo & Delbufalo, 2018).

2.1.2. Stakeholder Theory

Engaging in social activism is one way for a business to demonstrate that it is trying to please the demands and prospects of all parties involved. Stakeholder theory states that a company's capability to effectively incorporate and oversee its connections with various stakeholder groups determines its level of achievement (Bamahros et al., 2022). The ESG practices, as stated by (Wang, 2024), demonstrate how companies are expanding to meet the needs of more participants. More information about a company's sustainability and accountability for its activities is sought after by participants (Tsang et al., 2023).

2.1.3. Upper Echelon Theory

A structure for comprehending how top executives' traits and backgrounds affect CG and ESG performance is offered by upper echelon theory (Li, 2024). The theory was created by (Hambrick & Mason, 1984) and is based on the notion that managers in businesses see their circumstances through very personal lenses. Managers' varying experiences, values, personalities, and other human characteristics lead to different interpretations of strategic situations. Furthermore, by applying this theory, researchers have looked at how the composition and procedures of the top management team affect business success as well as how the traits of the CEO affect business strategy and performance (Saiyed et al., 2023). Management group diversity improves shareholder value, especially in terms of educational experiences, but it can also have adverse impacts on age and economic status (Li, 2024). Although this theory highlights how executives traits affect business ethics, it is important to keep in mind that not all executive traits have an advantageous impact on ESG outcomes, indicating an intricate relationship among ESG and CG (Kim, 2022).

2.1.4. Signaling Theory

Spence (1973) uses the term "signaling theory" to address the issue of information asymmetry. The sender, receiver, and signal are the three concepts that constitute the signaling theory. The signaling theory describes how the sender sends signals about its quality to the receiver by undertaking actions (Yuniningsih et al., 2018). Inadequate information in the hands of external parties can influence decisions. The other side of the information asymmetry problem is that insufficient information among investors makes it difficult for them to evaluate the performance of managers who work optimally, which negatively affects investors' perceptions and firm value (Su et al., 2016).

2.2. Corporate Governance

Several factors, such as corporate bankruptcy, hostile takeovers, and antisocial behavior by some companies, have contributed to the increased popularity of corporate governance (Aladwan et al., 2024; Samara & Nassar, 2023; Grantham, 2020). This is because they play a vital role in preserving economic stability, improving business quality, and resolving crises in monetary and non-monetary establishments, especially in the wake of multiple multinational corporations' bankruptcy and collapse (Alodat et al., 2022). The application of good governance ensures that just and open laws and regulations safeguard the rights of economists and investors, and preserve trust in the nation's economy (Nugroho, 2021)

In this study, corporate governance diversity will be measured through the following dimensions:

2.2.1. Board Gender Diversity

The connection between GD on boards and CG has attracted much attention, mainly because of its impact on shareholder value and advancement of CSR (Alslaibi et al., 2025; Alhosani & Nobanee, 2023). Gender diversity is crucial for enhancing corporate responsibility and ethical standards, as research has shown that having more women on boards improves CSR reporting and adherence to good governance practices (Masa'deh et al., 2024; Muhammad et al., 2023). While the U.S. disclosure model results in a superficial understanding of diversity, empirical evidence from the Norwegian quota system suggests that gender diversity improves the quality of corporate governance (Dhir, 2006). Physical location has an impact on the significant beneficial relationship between BGD and success in CSR, according to a meta-analysis of multiple studies (Wu et al., 2022). Despite the acknowledged potential advantages, research indicates that, in certain situations, such as Malaysia, the correlation between corporate governance and shareholder value may not be considerably affected by board gender diversity (Siong Chin et al., 2019).

2.2.2. Board-Specific Skills

Improving a efficiency of the business and accountability requires a relation amid corporate governance and the percentage of board-specific skills. Research indicates that a board's abilities significantly influence corporate governance practices, particularly in improving environmental responsibility and calibrating financial reporting (Benkraiem et al., 2021). As stated by (Cheng et al., 2024), a firm's corporate environmental responsibility can be improved by having a diverse board of directors and encouraging pro-environmental practices. Legal pressures, particularly following the implementation of environmental laws, amplify the benefits of board-specific CG skills (Cheng et al., 2024). The level of reporting oversight board expertise and quality of income have been found to positively correlate, suggesting that companies with highly skilled boards typically report higher-quality earnings (Hashim et al., 2019). The possibility of a complex, context-specific relationship between a higher percentage of independent directors and lower earnings quality is intriguing (Hashim et al., 2019).

2.2.3. Board Cultural Diversity

Corporate governance is significantly impacted by improved risk management, decision-making processes, and overall governance efficacy, which result from board cultural diversity (Yilmaz et al., 2023). Diverse boards with respect to gender, ethnicity, and occupation are linked to improved company productivity and administration results (Gangi et al., 2023). Diverse perspectives lead to more comprehensive decision making, which is why studies indicate that a diverse board encourages better governance practices (Dodd et al., 2022). In the opinion to Xiao (2024), a positive correlation between diversity and governance outcomes in Kenyan state corporations. This finding suggests that inclusivity is a prerequisite for effective leadership. CSR and the function of mediation Research from South Africa suggest that cultural diversity on boards enhances sustainability performance by acting as a mediator in the connection among comprehensive reporting and CSR (Lajnef & Dhifi, 2024). While there is a wealth of evidence demonstrating The rewards associated with having a board with diversity, some argue that, in the absence of an inclusive and supportive organizational culture, diversity on its own cannot guarantee good governance (Thapa, 2024).

2.2. ESG Performance

Governments, investors, and speculators are concerned about ESG risk management. Today, companies are excited about ESG as a new element of their competitive strategy. Over 35 years of academic literature have addressed the role of ESG information, highlighting the high quality and pertinence of ESG exposure. Therefore, to evaluate a firms operations and performance, investors and stakeholders must deliberate non-financial factors such as ESG factors (Wang, 2024); these criteria have gained popularity because investors, especially those who identify as "socially responsible investors," have used ESG to evaluate potential investments and as a gauge of opportunities and risks that may affect the ability of a business to produce value over time (Chebbi & Ammer, 2022)

Academic research has recently placed a great deal of emphasis on the interaction between CG and ESG factors. Scholars such as (Ahmad et al., 2023; Chebbi & Ammer, 2022) have drawn attention to the possible link among disclosures relating to ESG and improved CG practices, highlighting the tactical value of both in the governance of businesses. Conversations by (Adeneye et al., 2024; Bamahros et al., 2022; Uzliawati et al., 2023) have emphasized how particular CG elements affect business worth and ESG performance. These elements consist of committees for auditing, gender diversity, board size, and independence.

Despite varying views across various parts of the country, there is general agreement regarding the critical role that particular system of governance play in encouraging disclosures related to ESG (Ab Aziz et al., 2023). several studies, by (Kuzey et al., 2023; Rooh et al., 2021), express conflicting opinions and imply that CG might erode the link among useful ESG involvement and board composition.

Female directors' professional and educational backgrounds further reinforce this relationship, indicating that diverse governance can improve ESG outcomes (Ahmad et al., 2023). Furthermore, ESG ratings are soft regulations that boost corporate green innovation and increase ESG scores. This is particularly true in high-pollution industries, where ESG ratings encourage investment in green technology (Chen et al., 2023). Although the data indicates that corporate governance improves ESG scores, it is crucial to keep in mind that various systems of government could have various outcomes (Rooh et al., 2021).

2.3. Profitability, ESG and Corporate Governance

ESG and CG are related, because some studies have demonstrated that successful ESG practices can improve financial results and corporate efficacy (Akhter & Hassan, 2024; Xie et al., 2019). Researchers have found that companies that exhibit strong ESG disclosures typically exhibit higher levels of corporate productivity, particularly in the area of governance, which is positively correlated with performance. The notion that sustainability efforts can ultimately increase profitability is supported by scientific research, which demonstrates that nonfinancial performance including ESG factors has a beneficial effect on financial wellness in general (Min et al., 2015).

As Butt et al. (2023), the market value of firm assets divided by the price of replacement is known as Tobin's Q. Tobin's Q is partially responsible for mediating the complex interaction among CG and ESG factors (Xu et al., 2022). Studies show a beneficial connection among Tobin's Q and ESG performance, indicating that businesses with robust ESG policies typically command greater valuations (Akhter & Hassan, 2024). (Qin, 2023) found a significant beneficial association among Tobin's Q and ESG performance, highlighting the contribution of ethical procedures to value enhancement. Tobin's Q, however, demonstrates that disclosure about governance has a negative impact on company profitability and that ineffective governance can reduce firm value (Marheni et al., 2024). Sumarno et al. (2023) discover that a connection among firm value and ESG inspection is mediated by profitability. Tobin's Q results are correlated with improved oversight practices, and company success is greatly enhanced by the governance element of ESG (Zhang & Pang, 2024). However, it is important to remember that various research studies have identified different amounts of support promoting this connection, indicating the need for additional study in an array of settings. The findings show that Tobin's Q positively mediates the relationship between ESG and governance (Wicaksono & Muchtar, 2024). Environmental Pillar and Profitability

The environmental component of ESG has received substantial scholarly attention, largely due to increasing regulatory pressure and public concern over climate change. Theoretically, environmentally responsible firms are expected to benefit from lower operating costs, reduced risk exposure, and enhanced brand reputation, which collectively improve financial outcomes (Ge, 2024; Wang, 2024). Wang, 2024 underscores the role of environmental strategies in aligning firms with regulatory shifts toward low-carbon economies, suggesting that firms adopting proactive environmental policies may secure long-term cost savings and stakeholder support. (Liu et al., 2022) further argue that environmentally sustainable firms enjoy reputational advantages that attract capital from socially conscious investors, thereby enhancing market valuation. Empirical evidence also supports this view. (Özer et al., 2023) found that firms with high environmental scores outperform peers in risk-adjusted returns, attributing this to reduced regulatory liabilities and operational efficiencies. Yet, not all findings are consistent. (Gholami et al., 2022) reported no significant association between environmental performance and profitability in non-financial sectors, raising concerns about overgeneralization. This suggests that environmental strategies may yield varying financial benefits depending on industry characteristics, regulatory enforcement, and cost structures.

The social dimension of ESG, which encompasses employee relations, community engagement, and customer satisfaction, has also been posited to drive profitability by enhancing stakeholder trust and brand loyalty. (Shahrun et al., 2023) demonstrate that companies investing in social initiatives experience elevated corporate value due to improved public perception and market responsiveness. Similarly, (Tang et al., 2025) found that in socially sensitive industries, firms with high social performance tend to outperform those with limited stakeholder engagement. (Luo et al., 2024) supports this by noting that robust social performance can mitigate reputational risks, increase customer acquisition, and enhance employee retention, thereby contributing to long-term financial sustainability. Nonetheless, the positive association between social engagement and profitability is not universally observed. (Mooneeapen et al., 2022) caution that in regions with weak institutional frameworks or high public-sector corruption, social initiatives may fail to generate intended financial returns. In such contexts, the reputational benefits of social investments may be undermined by public skepticism or misalignment with local governance structures.

While the environmental and social dimensions of ESG contribute independently to performance outcomes, the governance pillar is increasingly recognized as both an essential determinant and moderator of ESG effectiveness. Good governance practices—including board independence, transparency, and diversity—are theorized to reduce agency costs, mitigate information asymmetry, and ensure strategic alignment between ESG objectives and profitability (Jizi, 2017; Tan, 2024). Empirical studies support this view. (Feng et al., 2024) highlight that governance structures enhance the credibility and execution of ESG initiatives, particularly in stakeholder-sensitive environments. (Zhou et al., 2022) found that firms with effective governance frameworks are better positioned to derive economic returns from ESG strategies, suggesting that governance acts as a catalyst for converting ESG engagement into financial performance. (Xie & Chen, 2024) further argue that governance mechanisms play a risk-mitigating role, insulating firms from reputational and compliance failures that may arise from ESG shortcomings. (Wang et al., 2023) emphasize that well-governed firms can better align shareholder and stakeholder interests, thereby optimizing resource allocation for ESG integration. Yet, the governance-performance relationship is not devoid of complexity. (Liu et al., 2025) warn that excessive regulatory burden and compliance costs associated with governance reforms may erode profitability, especially in firms where ESG compliance is superficial or driven by external pressure rather than intrinsic commitment.

In light of the earlier literature, the following hypothesis was accepted:

H.1 *ESG positively affect firm performance*

H.2 *Board diversity has a moderating effect between ESG and firm performance*

3. Methodology

3.1. Study Sample

The research population consisted of 2054 listed companies from 34 European countries covering the period of (2014–2023) annual data; total missing company data were excluded, reaching a final sample of 1321 and 12569 observations. Table 1 summarizes the Thomson Reuters classification’s sample selection, countries, and industry coverage.

Table 1
Sample Selection and Distribution

Sample Selection	Firms	Percentage
Total Companies	2054	100%
Omitting partial and full missing Values	800	38%
Final Sample	1254	62%
Number of Sample according to industry		
Austria	228	1.814%
Belgium	291	2.315%
Czech Republic	30	0.239%
Denmark	373	2.968%
Faroe Islands	10	0.080%
Finland	257	2.045%
France	1063	8.457%
Germany	1167	9.285%
Greece	267	2.124%
Guernsey	93	0.740%
Hungary	75	0.597%
Iceland	5	0.040%
Ireland; Republic of	329	2.618%
Isle of Man	10	0.080%
Italy	1023	8.139%
Jersey	35	0.278%
Liechtenstein	10	0.080%
Lithuania	4	0.032%
Luxembourg	187	1.488%
Malta	40	0.318%
Monaco	20	0.159%
Netherlands	479	3.811%
Norway	363	2.888%
Poland	358	2.848%
Portugal	136	1.082%
Romania	37	0.294%
Russia	372	2.960%
Slovenia	10	0.080%
Spain	656	5.219%
Sweden	1049	8.346%
Switzerland	982	7.813%
Ukraine	10	0.080%
United Kingdom	2586	21%
Total	**12545**	**100%**
Observations based on Sector		
Communication Services	774	6%
Consumer Discretionary	1360	11%

Sample Selection	Firms	Percentage
Consumer Staples	749	6%
Energy	471	4%
Financials	2011	16%
Health Care	914	7%
Industrials	2594	21%
Information Technology	752	6%
Materials	1118	9%
Others	430	3%
Real Estate	751	6%
Utilities	631	5%
Total	**12545**	**100%**

3.2. Study Variables

The Thomson Reuters Eikon database's ESG scores served as the research's dependent variable (DV). Based on data reported on ESG, a company's score is known as the ESG Combined score for Europe countries (Al Amosh & Khatib, 2023; Vural-Yavaş, 2021).

Using Primary Component Analysis (PCA), this study assesses the following independent variables (IV): Corporate Governance diversity (Board Gender Diversity, Percentage of Board Specific Skills, Percentage of Board Cultural Diversity). Additionally, as shown in Table 2, firm profitability (Tobin's Q) was chosen as a dependent variable.

Table 2
Study Measurement

Variables	Symbol	Measurement	Citation
Moderating Variable			
Corporate Governance Diversity	**CGD**		
Board Gender Diversity	BG	Proportion of women on the board	(Orazalin, 2020)
Percent Board Specific Skills Diversity	PBSS	Proportion of board members with either industry-specific expertise or a solid financial background	(Yunos et al., 2012)
Percent Board Cultural Diversity	PBCD	Proportion of board members with cultural backgrounds differing from the location of the corporate headquarters.	(Yilmaz et al., 2023)
Dependent Variable			
Tobin's Q	TQ	Computed by the Ratio of the market value of the firm to the book value of assets (Market value of Equity Book value of Debts)/ Book Value of Total Assets.	(Singh et al., 2018)
Independent Variable			
Environmental Pillar	ENVP		Alslaibi & Abdelkarim, (2024);
Social Pillar	SCP		
Governance Pillar	GVP		
Control Variables			
Firm Size	FS	Log total assets	
Leverage	LV	Total Liabilities/ Total Assets	
Covid	CV	Dummy variable for years above 2019 = 1	

Source(s)

Authors' own creation.

By condensing CGD variables into principal components, PCA facilitates the creation of composite indicators that provide a more precise and interpretable representation of the governance performance. This approach is particularly efficacious in empirical studies, where multicollinearity among variables can obscure meaningful insights (Abdi & Williams, 2010). Employing PCA for CG ensures that the key dimensions are objectively quantified, allowing for robust

comparisons and analyses across firms and industries. Thus, the integration of PCA enhances the methodological rigor of governance research, providing a data-driven foundation for examining its impact on organizational outcomes.

3.3. Regression Model Analysis

Given the dynamic nature of firm performance and the potential endogeneity of ESG and governance variables, the study employs the two-step system Generalized Method of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). This approach corrects for unobserved firm-specific heterogeneity, simultaneity bias, and dynamic endogeneity by using lagged levels and differences of endogenous variables as instruments.To ensure the robustness of the results and address potential measurement bias in firm performance, the study employs an alternative specification of Tobin's Q.

Model 1 - $TQ_t = \beta 0 + \beta 1 ESG\ Pillars it + \beta 2 Conit + \varepsilon_{it}$

Model 2 - $TQ_{it} = \beta 0 + \beta 1 ESG\ Pillars it + \beta 2 CGD + \beta 3 CDG*ESGeffect\ \beta 4 Conit + \varepsilon_{it}$

Where:

ESG_{it}: ESG Combined score for firm iii.

CGD = PCA for Corporate Governance diversity variables

Conit = Control Variables (LV, FS, CV)

*CDG*ESGeffect = moderation effect*

β0 = Regression equation constant.

TQ = Tobin Q

εit = Error term

i = Observation

t = Year of observation

3.4 Robustness Checks

To ensure the validity and reliability of the dynamic panel model, several diagnostic tests were conducted. First, the Arellano-Bond test for first-order and second-order autocorrelation (AR(1) and AR(2)) was employed to confirm the absence of serial correlation in the first-differenced residuals, a necessary condition for GMM consistency. Second, the Hansen and Difference-in-Hansen tests of overidentifying restrictions were used to assess the validity of the instrument set and the exogeneity of instrument subsets. To prevent instrument proliferation and overfitting bias—common concerns in GMM estimation—the number of instruments was reduced by employing the collapse option and limiting the lag depth. In addition to these diagnostic tests, a robustness check was performed by re-estimating the core models using an alternative proxy for firm performance. While the main analysis relied on the conventional Tobin's Q measure (market value of equity plus total liabilities divided by total assets), the robustness specification used a simplified ratio of market capitalization to book value of total assets, commonly referred to as TQS. This alternative formulation addresses potential biases arising from data limitations in replacement cost values. The results obtained using TQS were consistent with those derived from the original specification, thereby reinforcing the robustness and generalizability of the study's findings.

4. Results

4.1. Descriptive Statistics

There were descriptive statistics used. The mean and standard deviation for numerical variables, as well as the minimum and maximum values, were among the standard descriptive statistics used to characterize the data .

Table 3

Table 3
Descriptive Statistics Results for Independent Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
TQ	12545	2.279	6.741	.001	334.852
SCP	12545	1.738	.231	− .45	2.253
GVP	12545	1.675	.248	− .309	2.274
ENVP	12441	1.679	.284	− .885	2.232
BG	12329	1.453	.195	.62	2
PBSS	12432	1.532	.26	.538	2
PBCD	8337	1.334	.333	0	2
FS	12545	9.915	.939	5.532	13.719
LV	12545	.594	.246	0	5.202
CV	12545	.417	.493	0	1

The results of the descriptive analysis are shown in Table 3. Thus, according to Table 3, there are 12545 observations for most variables. TQ, the dependent variable of firm profitability, shows higher standard deviations. For robustness, an alternative specification—TQS—is employed, calculated solely as the market value of equity over book value of assets, to account for market-based valuation independent of debt structure.

4.2. Correlation Analysis

The presence of multi-collinearity among the independent variables may lead to incorrect inferences. The Pearson correlation and variance inflation factor (VIF) tests were used to check for multi-collinearity.

Table 4
Pearson Correlation Coefficient and Variance Inflation Factor

Variables	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) TQ		1.000									
(2) SCP	1.668	-0.123	1.000								
(3) GVP	1.331	-0.070	0.415	1.000							
(4) ENVP	1.719	-0.080	0.584	0.341	1.000						
(5) BG	1.169	-0.018	0.228	0.238	0.207	1.000					
(6) PBSS	1.051	0.035	-0.063	0.066	-0.074	-0.089	1.000				
(7) PBCD	1.055	0.036	0.008	0.140	-0.049	-0.023	0.139	1.000			
(8) FS	1.325	-0.195	0.246	0.201	0.375	-0.005	-0.100	-0.046	1.000		
(9)LV	1.178	-0.066	0.149	0.130	0.233	0.045	-0.031	-0.077	0.368	1.000	
(10) CV	1.08	0.002	0.125	0.151	0.126	0.248	-0.003	0.007	0.062	0.029	1.000

The correlation matrix in Table 4 shows no severe collinearity between the independent variables. All the correlation coefficients (r) were less than (0.80).

The Variance Inflation Factor (VIF) is calculated to further assess the presence of multi-collinearity. A VIF coefficient exceeding (10) suggests the existence of multi-collinearity (Chatterjee & Simonoff, 2013). Table 4 indicates a mean VIF of (1.286), which is significantly lower than the threshold of ten. Additionally, the individual variables' VIFs are relatively small, supporting the earlier assumption that the model's explanatory variables do not exhibit a substantial correlation.

4.3. Regression Result

Table 5 summarizes the results of the two-step system GMM estimation assessing the direct effect of the ESG pillars on firm performance, using both the standard and robustness-adjusted Tobin's Q measures (TQ and TQS). In all models, the lagged dependent variable is highly significant ($p < 0.001$), confirming the persistence in firm valuation over time. However, the coefficients of ESG components—ENVP, SCP, and GVP—are not statistically significant in predicting TQ or TQS. For example, the coefficient of ENVP in the baseline model is -21.257 ($p = 0.673$), suggesting no robust direct relationship between environmental disclosures and firm value. Similarly, SCP and GVP exhibit coefficients near zero with p-values exceeding 0.3 in all specifications. Control variables, including FS and LV, exhibit mixed effects and lack significance in most models. Interestingly, the CV is positive and significant ($p < 0.01$) only in models where SCP is used, suggesting heightened investor responsiveness to social practices during the pandemic. Model diagnostics provide strong support for the validity of the GMM estimators. The Arellano-Bond tests confirm the presence of first-order autocorrelation ($p < 0.05$) and the absence of

second-order autocorrelation (p > 0.89). Hansen test statistics are consistently non-significant (p > 0.10), indicating valid instrument sets. Although the Sargan test is rejected, this may be attributed to the large number of instruments rather than misspecification.

Table 6 presents the interaction effects between CGD and ESG pillars using both TQ and TQS as dependent variables. Results indicate that BG has a marginally significant positive association with firm performance in models that include ENVP (β = 2.308, p = 0.069), suggesting a degree of market appreciation for gender-diverse boards in environmental contexts. The interaction term (CDG*ESGeffect) demonstrates statistical significance in select models. Specifically, in the ENVP model, the interaction term is negative and significant (β = -0.801, p = 0.008), suggesting that while BG is individually beneficial, excessive reliance on governance diversity may dampen the effectiveness of environmental initiatives in enhancing firm value. In contrast, the interaction term is positive and significant in the SCP model (β = 0.142, p = 0.020), implying that SCP activities are more effective when combined with governance diversity. Firm size is negatively associated with firm performance in ENVP-related models (p < 0.01), while LV and CV controls show inconsistent effects. These patterns are largely consistent across both TQ and TQS specifications, underscoring the robustness of the findings to alternative profitability measures. Diagnostic tests again affirm model credibility. AR(1) p-values range between 0.025 and 0.139, and AR(2) p-values consistently exceed 0.89. Hansen tests yield high p-values (p > 0.60), suggesting that the instruments used in the models are valid. The Sargan test remains significant, warranting cautious interpretation due to potential instrument proliferation.

Table 5
Direct effect - Dynamic panel-data estimation, two-step system GMM

Variables	**ENVP**				**SCP**				**GVP**			
	TQ		**TQS**		**TQ**		**TQS**		**TQ**		**TQS**	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
L	.75	0***	.94	0***	.922	0	.923	0	.929	0	.928	0
Pillar	-21.257	.673	-32.677	.58	− .344	.408	− .3	.342	− .564	.779	− .374	.779
FS	-6.981	.289	3.545	.611	− .021	.467	− .018	.402	.013	.889	− .002	.889
LV	8.779	.587	-72.883	.583	.043	.866	− .092	.351	.052	.938	− .062	.938
CV	2.897	.493	.776	.547	.159	0	.156	0	.188	.287	.171	.287
Constant	-69.406	.658	575.235	.58	.815	.299	.746	.216	.784	.695	.646	.695
Mean dependent var		2.274		1.675		2.263		1.668		2.263		1.668
Number of obs		11120		11120		11212		11212		11212		11212
SD dependent var		6.859		6.877		6.832		6.849		6.832		6.849
F-test		746.280		461.009		3886.124		1845		3719		1702
*** p<.01, ** p<.05, * p<.1												
Model Diagnostics												
Arellano-Bond test for AR(1) in first differences:	z = -1.64 Pr > z = 0.101		z = -0.64 Pr > z = 0.523		z = -2.40 Pr > z = 0.016		z = -2.39 Pr > z = 0.017		z = -2.41 Pr > z = 0.016		z = -2.40 Pr > z = 0.016	
Arellano-Bond test for AR(2) in first differences:	z = 0.01 Pr > z = 0.991		z = -0.43 Pr > z = 0.664		z = 0.13 Pr > z = 0.899		z = 0.13 Pr > z = 0.897		z = 0.12 Pr > z = 0.901		z = 0.13 Pr > z = 0.899	
Sargan test of overid. restrictions:	chi2(3) = 66.03 Prob > chi2 = 0.000		chi2(1) = 37.68 Prob > chi2 = 0.000		chi2(34) = 345.19 Prob > chi2 = 0.000		chi2(34) = 340.55 Prob > chi2 = 0.000		chi2(34) = 335.75 Prob > chi2 = 0.000		chi2(34) = 325.32 Prob > chi2 = 0.000	
Hansen test of overid. restrictions:	chi2(3) = 0.11 Prob > chi2 = 0.991		chi2(1) = 0.00 Prob > chi2 = 0.999		chi2(34) = 31.09 Prob > chi2 = 0.611		chi2(34) = 31.07 Prob > chi2 = 0.612		chi2(34) = 43.74 Prob > chi2 = 0.122		chi2(34) = 40.76 Prob > chi2 = 0.197	

Table 6
Moderation effect - Dynamic panel-data estimation, two-step system GMM

Variables	ENVP				SCP				GVP			
	TQ		TQS		TQ		TQS		TQ		TQS	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
L	.732	0***	.729	0***	.916	0***	.916	0***	.924	0***	.924	0***
Pillar	5.24	.165	5.395	.131	− .595	.321	− .442	.376	− .126	.79	− .251	.66
BG	2.308	.069*	2.289	.082*	− .285	.013**	− .26	.013**	− .161	.105	− .189	.367
CDG*ESGeffect	− .801	.008***	− .799	.011**	.142	.02**	.129	.021**	.089	.13	.107	.382
FS	-4.052	.004***	-4.032	.005***	− .066	.119	− .052	.148	− .009	.748	− .016	.459
LV	33.088	.416	31.847	.438	.144	.571	− .106	.453	− .178	.596	− .194	.05**
CV	.923	.01**	.913	.014**	.019	.502	.018	.492	.014	.637	.02	.456
Constant	-121.746	.088*	-120.962	.106	1.77	.083*	1.454	.074	.533	.558	.778	.475
Control for Countries		Yes										
Mean dependent var		2.489		1.864		2.482		1.859		2.482		1.859
Number of obs		7318		7318		7344		7344		7344		7344
SD dependent var		8.304		8.321		8.290		8.307		8.290		8.307
F-test		100.056		43.631		1178.695		700.919		2161.324		1340.550
*** p<.01, ** p<.05, * p<.1												
Model Diagnostics												
Arellano-Bond test for AR(1) in first differences:	z = -1.48 Pr > z = 0.139		z = -1.52 Pr > z = 0.129		z = -2.23 Pr > z = 0.025		z = -2.23 Pr > z = 0.026		z = -2.24 Pr > z = 0.025		z = -2.23 Pr > z = 0.026	
Arellano-Bond test for AR(2) in first differences:	z = -0.13 Pr > z = 0.893		z = -0.09 Pr > z = 0.927		z = 0.11 Pr > z = 0.914		z = 0.11 Pr > z = 0.913		z = 0.11 Pr > z = 0.916		z = 0.11 Pr > z = 0.914	
Sargan test of overid. restrictions:	chi2(8) = 54.47 Prob > chi2 = 0.000		chi2(8) = 54.76 Prob > chi2 = 0.000		chi2(37) = 309.78 Prob > chi2 = 0.000		chi2(37) = 306.58 Prob > chi2 = 0.000		chi2(37) = 303.22 Prob > chi2 = 0.000		chi2(37) = 294.43 Prob > chi2 = 0.000	
Hansen test of overid. restrictions:	chi2(8) = 1.40 Prob > chi2 = 0.994		chi2(8) = 1.37 Prob > chi2 = 0.995		chi2(37) = 32.70 Prob > chi2 = 0.671		chi2(37) = 32.10 Prob > chi2 = 0.698		chi2(37) = 50.32 Prob > chi2 = 0.071		chi2(37) = 49.72 Prob > chi2 = 0.079	

5. Discussion

This study investigated the impact of Environmental, Social, and Governance (ESG) pillars on firm profitability, with a specific focus on the moderating role of corporate governance diversity (CGD). Drawing on agency, stakeholder, and upper echelon theories, the analysis sought to empirically validate two central hypotheses. The results of the two-step system GMM regression suggest that the direct effects of ENVP, SCP and GVP on Tobin's Q were statistically insignificant across all model specifications. These findings challenge the dominant stream of literature affirming ESG's financial benefits (Ge, 2024; Özer et al., 2023; Wang, 2024), where environmental and social practices were linked to enhanced profitability through cost efficiencies, risk reduction, and improved stakeholder trust. Conversely, the current study aligns more closely with (Gholami et al., 2022), who reported no significant relationship between ESG performance and profitability in certain sectors. These discrepancies may be attributable to contextual factors such as sectoral differences, country-level ESG maturity, or measurement challenges inherent in ESG scores. Therefore, H1 is rejected based on the insignificance of the direct ESG-profitability relationship in this context.

In contrast to the direct effects, the moderation models revealed significant interaction terms for specific ESG pillars and governance diversity dimensions. Notably, CGD showed a marginally positive direct effect on firm performance in the environmental model (p = 0.069), suggesting that diverse boards may enhance environmental strategy outcomes—a finding consistent with (Dhir, 2006; Muhammad et al., 2023). Furthermore, the interaction term (CDG*ESGeffect) was significant and negative for ENVP (β = -0.801, p = 0.008), implying that while board diversity is individually beneficial, its excessive or misaligned application may dilute the environmental pillar's financial impact. This nuanced effect reflects earlier literature warning against tokenistic or

non-integrated diversity initiatives (Thapa, 2024). Conversely, in the case of the SCP, the interaction term was positive and significant (β = 0.142, p = 0.020), suggesting that social practices are more effective when supported by diverse governance structures. This is in line with (Luo et al., 2024; Shahrun et al., 2023), who emphasized that social investment yields stronger returns in inclusive and well-governed environments. These results validate upper echelon theory (Hambrick & Mason, 1984), which argues that leadership diversity enriches strategic interpretation and responsiveness to stakeholder needs. Thus, H2 is accepted, albeit with differentiation across ESG dimensions—supporting a contingent view of governance's moderating role.

Overall, while the direct influence of ESG on firm performance was not established, the findings underscore the importance of context and the enabling role of governance diversity. Effective ESG outcomes appear to depend less on disclosure quantity and more on the strategic alignment fostered by diverse and competent boards. This supports recent calls for deeper integration of ESG into core governance practices, rather than treating it as a parallel or symbolic initiative.

6. Conclusion

The findings of this study carry several implications for corporate leaders, policymakers, and investors. Firstly, the absence of a significant direct relationship between ESG performance and firm profitability suggests that merely adopting ESG practices or achieving high ESG scores may not be sufficient to generate financial returns. This challenges the common managerial assumption that ESG, by default, enhances firm value. Instead, the results underscore the importance of how ESG is embedded and governed within organizations. Companies aiming to achieve meaningful returns from ESG strategies should ensure that these initiatives are championed by a board with diverse perspectives, experiences, and competencies.

The positive moderating effect of board diversity on the relationship between the social and environmental pillars of ESG and firm performance provides actionable insight. Firms should treat board diversity not as a symbolic gesture but as a strategic asset. For policymakers and regulators, the findings advocate for governance frameworks that encourage or mandate diversity at the board level, as this enhances the firm's ability to interpret and implement ESG initiatives effectively. Investors, in turn, should look beyond ESG disclosure scores and evaluate whether firms have the internal governance capacity—particularly through diverse leadership—to transform ESG policies into performance-enhancing strategies.

The results contribute to the ongoing theoretical debate about the ESG-performance link by both confirming and challenging established theories. The study challenges the assumption in stakeholder theory that attending to broad stakeholder interests (as operationalized through ESG) inherently results in superior firm performance. The lack of significant direct effects suggests that the benefits of ESG are not universally automatic and may depend on how these practices are aligned with the firm's internal capabilities and strategic priorities. Conversely, the findings lend support to upper echelon theory (Hambrick & Mason, 1984), which posits that organizational outcomes are influenced by the characteristics and cognitive frames of top executives and board members. The significant interaction effects between board diversity and ESG dimensions confirm that leadership composition—specifically, gender diversity—plays a crucial role in shaping the effectiveness of ESG strategies. This implies that the heterogeneity of boards enriches decision-making, particularly in interpreting complex, multi-dimensional sustainability issues. The study also partially supports agency theory by emphasizing the role of governance mechanisms in aligning managerial actions with stakeholder and shareholder interests. Although ESG adoption alone does not guarantee performance gains, board diversity can serve as a governance tool that mitigates potential agency conflicts by fostering broader oversight and inclusive perspectives on strategic initiatives. Overall, the findings point toward a contingency-based theoretical framework, where the value of ESG initiatives is not universal but shaped by contextual and organizational factors such as board structure. This reinforces the view that ESG-performance outcomes must be understood through a multidimensional lens that integrates strategy, governance, and institutional design.

Despite its contributions, the study faces certain limitations. First, the analysis relied on secondary ESG scores, which may mask intra-dimensional differences or contextual nuances. Second, while the GMM approach addresses endogeneity, it may still be sensitive to instrument proliferation and omitted variables. Third, the study focuses on European listed companies, which may limit generalizability to other regions with different ESG maturity levels or governance cultures. Future research could expand by disaggregating ESG components further or exploring industry-specific dynamics. Longitudinal case studies or mixed-method approaches may also offer richer insights into how ESG strategies evolve and interact with board behavior over time. Moreover, examining other moderators—such as institutional ownership, regulatory pressure, or CEO characteristics—could enhance our understanding of the mechanisms linking ESG practices to firm value.

Declarations

Competing interests:

The authors declare that they have no competing interests.

Ethics, Consent to Participate, and Consent to Publish declarations

Not applicable. This study is based exclusively on secondary, firm-level data obtained from a commercial database and does not involve human participants, human data, human tissue, or animals; therefore, ethics approval, consent to participate, and consent to publish were not required.

Clinical trial number

Not applicable. This study is not a clinical trial.

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Author Contribution

E.M.: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Software, Validation, Visualization, Writing – original draft, Writing – review & editing, Project administration, and Funding acquisition. L.B.: Writing – review & editing (critical review and proofreading of the manuscript). All authors read and approved the final manuscript.

Data availability:

The data that support the findings of this study were obtained from Refinitiv (LSEG Data & Analytics). Restrictions apply to the availability of these data, which were used under licence for the current study and are therefore not publicly available. The data are, however, available from the corresponding author upon reasonable request and with the permission of LSEG.

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