Governance Moderation in ESG Impact: Market Value Shifts Pre- and Post-COP 21 in the Oil and Gas Sector

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ABSTRACT

This study examines the effect of ESG performance on firm market value in the oil and gas sector, using 6,872 firm-year observations from 52 countries (2011–2022). A two-stage least squares (2SLS) regression is employed to address endogeneity, with institutional governance government effectiveness, regulatory quality, and control of corruption tested as moderators. Results show ESG positively impacts firm value only after COP21. Institutional quality enhances firm value but weakens ESG's marginal effect. The findings highlight the conditional nature of ESG's value relevance and offer implications for firms, investors, and policymakers in varying governance contexts.

Keywords: ESG, Corporate Governance, Firm Market Value, COP21, Oil and Gas Sector
JEL Classifications: G32, G38, M14, Q56, O16

1. INTRODUCTION

In recent years, Environmental, Social, and Governance (ESG) performance has emerged as a central consideration for investors, policymakers, and corporate managers seeking to align business practices with broader sustainability goals. This shift has been particularly pronounced in resource-intensive sectors such as oil and gas, where environmental concerns and social accountability are closely scrutinized. Despite the growing emphasis on ESG disclosure and performance, the extent to which ESG contributes to firm market value remains a subject of ongoing debate in the literature. While some scholars argue that ESG enhances firm value through improved reputation, risk management, and stakeholder engagement (Fatemi et al., 2018; Cheng et al., 2014), others contend that the costs associated with ESG implementation may offset its potential benefits, especially in sectors with heavy regulatory burdens and volatile earnings (Krüger, 2015).

Moreover, the institutional environment in which a firm operates may influence how ESG performance is perceived and priced by the market. Country-level governance quality reflected in factors such as regulatory effectiveness, rule of law, and corruption control can shape investor expectations, stakeholder pressures, and the materiality of ESG efforts (Ioannou and Serafeim, 2012; Aguilera et al., 2006). However, empirical evidence on the moderating role of institutional governance in the ESG–firm value relationship remains limited and mixed, particularly in the context of emerging versus developed markets, and before versus after major global climate accords such as the COP21 Paris Agreement.

To address these gaps, this study examines the impact of ESG performance on firm market value and the moderating role of institutional governance quality. The analysis focuses on the oil and gas sector, using a panel dataset of 6,872 firm-year observations from 934 firms across 52 countries spanning the period 2011 to 2022, obtained from the Thomson Reuters database. Three key dimensions of institutional quality government effectiveness, regulatory quality, and control of corruption are used as moderators to test how the ESG–value relationship varies across governance environments. The sample is further analyzed across two periods: Pre-COP21 (2011–2016) and post-COP21 (2017–2022), to capture

the evolving significance of ESG following global climate policy developments.

Using a two-stage least squares (2SLS) regression approach to address potential endogeneity concerns, the study provides robust evidence that ESG performance is positively associated with firm market value in the post-COP21 period. Additionally, the results show that institutional governance moderates this relationship: while stronger governance environments are generally associated with higher firm value, the marginal impact of ESG performance weakens under such conditions.

This study contributes to the ESG literature by demonstrating that the valuation relevance of ESG is both time-dependent and institutionally contingent, particularly in high-impact sectors such as oil and gas. The findings offer theoretical insights into how institutional context shapes the ESG–value dynamic and provide practical guidance for investors, firms, and policymakers operating in varied governance environments.

2. LITERATURE AND HYPOTHESES

2.1. ESG Performance and Firm Market Value

A growing consensus among scholars is that superior ESG performance contributes positively to firm market value, even within the capital and emissions-intensive oil and gas sector. ESG initiatives have evolved from being considered peripheral ethical choices to becoming central to strategic and financial decision-making. Dsouza and Krishnamoorthy (2024) demonstrate that although high ESG scores can exhibit a short-term negative impact on Tobin's Q due to immediate cost implications, firms with robust ESG frameworks benefit from enhanced profitability, operational efficiency, and lower risk premiums in the long run. These indirect financial gains often outweigh short-term market scepticism. Similarly, Xu et al. (2024) find a statistically significant and positive association between ESG performance and both profit margins and stock price resilience across a broad spectrum of industries, reinforcing the value relevance of ESG indicators. In energy-intensive sectors, strong ESG compliance can also buffer firms against environmental fines, regulatory shocks, and reputational risks, further contributing to market stability and investor confidence (Preker and Hulton, 2024; Ning and Shen, 2024).

Stakeholder-based mechanisms are increasingly viewed as pivotal to understanding how ESG translates into market value. As noted by Tan et al. (2025), firms that actively communicate their ESG practices attract heightened media visibility, greater analyst coverage, and increased institutional investor attention. These effects collectively improve firm valuation through enhanced information dissemination and credibility. Nurahman et al. (2024) similarly observe that ESG initiatives positively affect financial metrics like return on assets (ROA), return on equity (ROE), and enterprise value, even after controlling for firm size, industry, and regional effects. They emphasize that stakeholder trust in ESG signals serves as a key driver of capital market reactions, particularly in globalized economies.

Nonetheless, the empirical literature is not monolithic. Some studies present a more cautious or context-dependent interpretation of ESG's impact (e.g., Alvarez-Perez and Fuentes, 2024; García-Amate et al., 2023; Kaupke and Zu Knyphausen-Aufseß, 2023). However, in their studies firms found no significant direct relationship between ESG scores and firm performance, implying that ESG investments might not consistently translate into immediate market gains in sectors with entrenched carbon risk profiles. Furthermore, another research shows that while ESG scoring is effective in reducing systematic and firm-specific risk such as legal, environmental, and social controversies it does not always lead to abnormal positive returns (Khorilov and Kim, 2024). These mixed findings highlight the conditional nature of ESG value realization and underscore the importance of broader contextual variables such as industry dynamics, geographic governance environments, and investor expectations.

Theoretical underpinnings from Signaling, Stakeholder, and Institutional theories help contextualize these findings. According to Signaling Theory (Huang, 2022; Ma, 2024), ESG disclosures signal managerial competence and long-term orientation, reducing information asymmetry and attracting investors seeking sustainable and credible firms. Stakeholder Theory (Kulova and Nikolova-Alexieva, 2023; Talan et al., 2024; Wang, 2024) explains how firms engaging in ESG initiatives cultivate stronger ties with various stakeholders including customers, employees, suppliers, and investors who reward responsible conduct with loyalty, investment, and reduced transaction costs. Institutional Theory (Handoyo and Anas, 2024; Huang, 2022) adds that the strength of ESG's impact on firm value depends not just on the firm's internal practices, but also on the governance environment in which it operates. In contexts with strong rule of law, policy enforcement, and regulatory oversight, ESG disclosures are more likely to be credible and actionable, thereby enhancing their financial impact.

Taken together, the literature suggests that while the positive effect of ESG performance on firm market value is supported by numerous studies, the strength and direction of this relationship may vary depending on institutional factors, stakeholder reactions, and sector-specific challenges. For oil and gas companies often subject to intense scrutiny, climate litigation risk, and high fixed capital costs strong ESG performance can serve both as a shield against reputational damage and as a lever for long-term value creation. Together, these findings provide the foundation for developing the first hypothesis (H_1).

2.2. Governance Dimensions as Moderators: Government Effectiveness, Regulatory Quality, Control of Corruption

Governance quality is increasingly acknowledged as a critical moderating factor in the relationship between environmental, social, and governance (ESG) performance and firm value. Institutional-level factors such as government effectiveness, regulatory quality, and control of corruption form the foundation of a country's governance environment and have a substantial influence on how ESG initiatives are perceived, implemented, and rewarded in capital markets. These governance dimensions formulated in the Worldwide Governance Indicators (WGI)

framework by Kaufmann et al. (2011) and Thomas (2010) are central to institutional theory, which posits that stronger formal institutions create more predictable environments for corporate behavior. Moreover, stakeholder theory suggests that in high-governance environments, firms are under greater scrutiny from stakeholders, thereby enhancing the effectiveness of ESG disclosures and sustainability efforts (Alkhawaja et al., 2023; Itan et al., 2025; Memon, 2024).

Recent empirical studies provide compelling support for this moderating role. For example, Bokhari et al. (2023) found that strong regulatory and institutional frameworks significantly reinforce the relationship between CSR and financial performance, especially in contexts where ESG controversies are actively monitored. Similarly, Mooneeapen et al. (2022) argues that governance mechanisms such as legal enforcement and administrative transparency shape investor perceptions and moderate the ESG–performance link. Evidence from research reveals that state-led governance and effective anti-corruption efforts amplify the market value gains from ESG engagement (Previtali and Cerchiello, 2023). Other studies further support these findings, highlighting that internal governance practices such as independent boards, audit committee effectiveness, and anti-bribery policies enhance ESG's influence on firm outcomes (Wei et al., 2024). Theoretical arguments are increasingly supported by cross-country panel data analyses, which show that ESG contributes more positively to firm value in nations with robust governance systems (Almaqtari et al., 2024; Wang et al., 2023).

One essential component of this governance structure is government effectiveness. This dimension reflects the quality of public services, the professionalism and independence of civil servants, and the credibility of policy implementation (Kaufmann et al., 2011). In countries with high government effectiveness, firms operate in an environment characterized by predictable regulations, stable institutions, and efficient bureaucracy. Such conditions reduce the transaction costs associated with ESG implementation and increase the credibility of sustainability disclosures (Alkhawaja et al, 2023). For instance, governments with a clear climate policy agenda and reliable public infrastructure enable companies to align ESG efforts with long-term national priorities such as carbon neutrality, energy transition, and social inclusion (Spataru et al., 2024). Moreover, effective governments are more likely to enforce ESG-related laws and monitor compliance, reducing the likelihood of opportunistic behavior and boosting investor trust (Flaga-Gieruszyńska et al., 2024; Mendenhall and Sutter, 2023).

Equally vital is the control of corruption, which ensures the impartial use of public power and reduces opportunities for rent-seeking behavior. Corruption distorts market signals, weakens enforcement of ESG standards, and creates opportunities for firms to engage in symbolic or misleading ESG practices, often referred to as greenwashing (Mohammed, 2023; Zhao et al., 2024). In such settings, stakeholders and investors may be sceptical of ESG disclosures, thereby diminishing their impact on firm valuation. Conversely, in low-corruption environments, ESG information is more likely to be seen as credible and reflective of actual sustainability practices. Adeneye et al. (2023) demonstrate that firms operating in cleaner institutional environments in Southeast Asia attract more long-term capital and enjoy higher market premiums for ESG performance. Furthermore, corruption tends to crowd out investments in sustainable infrastructure and undermines corporate initiatives aimed at transparency, inclusion, and environmental responsibility (Cicchiello et al., 2025).

Another critical institutional factor is regulatory quality, which refers to the government's ability to design, implement, and enforce policies that support private sector development (Kaufmann et al., 2011). High-quality regulation creates a conducive environment for ESG integration by providing clarity, consistency, and predictability. Well-designed regulatory systems establish reporting standards, define ESG metrics, and offer financial incentives such as tax breaks and subsidies for sustainable business practices (Vijai and Wisetsri, 2025). Such clarity reduces policy-related uncertainty and encourages firms to adopt ESG frameworks as part of their long-term strategy rather than as ad hoc compliance tools. In markets with strong regulatory institutions, ESG leaders benefit from a level playing field, as non-compliant firms are more likely to be penalized or excluded from public tenders and investor portfolios (Dalla Riva, 2023). Deng et al. (2025) emphasize that regulatory quality also ensures fair competition and deters short-termism, further strengthening the association between ESG performance and long-term firm value.

In summary, the effectiveness of ESG strategies in enhancing firm value is highly contingent upon the quality of a country's institutional governance. Governance dimensions such as government effectiveness, control of corruption, and regulatory quality act as crucial moderators that determine whether ESG commitments are translated into credible, measurable, and valued outcomes. These findings collectively support the following moderated hypotheses: (H_{2a}) government effectiveness moderates the relationship between Firm ESG performance and firm market value, (H_{2b}) Control of corruption moderates the relationship between Firm ESG performance and Firm market value and (H_{2c}) regulatory quality moderates the relationship between Firm ESG performance and firm market value.

2.3. Theoretical Foundations and ESG Value under Governance and COP21 Context
The link between ESG performance and firm market value is widely supported by three major theories: Signaling, Stakeholder, and Institutional Theory. These frameworks explain not only the value relevance of ESG but also how governance conditions influence its effectiveness especially in response to global policy events like COP21 stands for the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). It was held in Paris, France, in December 2015.

Signaling Theory suggests that ESG disclosures serve as credible signals of a firm's long-term stability and ethical commitment, helping reduce information asymmetry (Arhinful et al., 2025; Huang, 2022). However, the credibility of these signals depends on institutional quality; weak governance environments risk

greenwashing or underenforcement, which diminishes the market's trust (Yan and Zhang, 2020).

Stakeholder Theory posits that firms engaging in ESG practices build legitimacy and trust with key stakeholders investors, employees, and communities who in turn reward the firm through higher engagement and valuation (Alkhawaja et al., 2023; Kandpal et al., 2024). ESG performance enhances media coverage, analyst attention, and institutional investment (Garcia et al., 2017; He and Li, 2024), particularly in socially sensitive industries like oil and gas.

Institutional Theory highlights that national governance quality shapes how ESG practices are perceived. Strong institutions, reflected in regulatory quality and corruption control, reinforce the credibility and enforcement of ESG disclosures, making them more impactful (Handoyo and Anas, 2024; Singhania and Saini, 2023). In contrast, weak institutions may erode the effectiveness of ESG in generating financial returns (Wu and Chen, 2024).

These dynamics became more pronounced after COP21, which marked a turning point in climate governance through the Paris Agreement. Post-COP21, ESG-related risks such as emissions, climate disclosures, and sustainability strategies became central to investor decisions. Following the COP21 conference and the signing of the Paris Agreement, the United Nations Environment Programme Finance Initiative (UNEP FI) observed an increase in companies reporting on their Environmental, Social, and Governance (ESG) practices, as well as growth in financial products linked to sustainability, while Semieniuk et al. (2021) show that investors increasingly penalize firms lacking credible transition strategies.

Importantly, governance strength moderated firms' responses to COP21. Companies in well-regulated environments were better able to align ESG with investor expectations, while firms in weak-governance countries faced implementation and credibility gaps (Alkhawaja et al., 2023; Ahmed et al., 2025). This reinforces the argument that governance conditions shape both ESG execution and market response.

In summary, ESG performance contributes to firm value, but its effectiveness is conditional on the strength of national institutions and external environmental pressures. The post-COP21 period offers a clear setting to test how governance moderates the ESG–value relationship. Therefore, we propose the following hypothesis:

- Hypothesis 1 (H_1). Firm ESG performance has an impact on Firm Market value.
- Hypothesis 3a (H_{2a}). Government effectiveness moderates the relationship between Firm ESG performance and Firm Market value.
- Hypothesis 3b (H_{2b}). Control of corruption moderates the relationship between Firm ESG performance and Firm Market value.
- Hypothesis 3c (H_{2c}). Regulatory Quality moderates the relationship between Firm ESG performance and Firm Market value.

3. RESEARCH DESIGN

This study utilizes a panel dataset of firms operating within the oil and gas sector, sourced from the Thomson Reuters database. The initial sample includes 934 firms from 52 countries over the period 2011 to 2022, resulting in a total of 6,872 firm-year observations. To ensure robustness and limit the influence of outliers, all continuous variables are winsorized at the 5% level, a technique commonly used in empirical accounting and finance research (e.g., Barth et al., 2001; Larcker and Rusticus, 2010).

The final dataset captures a diverse range of countries, with the largest representation from the United States (29.05%), followed by Canada (16.33%), the United Kingdom (5.38%), Australia (6.40%), and China (5.82%). Several emerging and frontier markets such as Brazil, India, Malaysia, and Saudi Arabia are also included, enhancing the cross-country validity of the findings. A full list of countries and their respective observation counts is presented in Table 1.

Given the possibility of endogeneity arising from omitted variables, reverse causality, or measurement error, the study employs a two-stage least squares (2SLS) regression model. This approach is appropriate for identifying causal effects in observational data, especially when potential endogeneity may bias the results of ordinary least squares (OLS) estimations (Wooldridge, 2010; Wintoki et al., 2012). The use of instrumental variables in the first stage of the 2SLS model helps isolate the exogenous variation in the potentially endogenous regressors, thus providing more consistent and unbiased estimates.

Furthermore, the study design allows for variation across both time and geography, which is particularly relevant in the oil and gas industry given its exposure to international regulations, commodity price fluctuations, and geopolitical risks. By accounting for these variations, the research offers more comprehensive insights into the determinants of firm behavior in this strategically important sector.

This table summarizes the number and percentage of firm-year observations across 52 countries in the oil and gas sector over the 2011–2022 period. The sample includes 6,872 observations, with the highest representation from the United States, Canada, the United Kingdom, Australia, and China.

3.1. Variables Definition

Table 2 summarizes the key variables used in this study, categorized into dependent, independent, moderating, and control variables. The dependent variable is firm market value, which is measured using Tobin's Q. This ratio, calculated as the market value of share capital plus the market value of net liabilities divided by total assets, serves as a widely accepted proxy for firm performance, particularly when examining the influence of non-financial indicators such as ESG performance (Lee et al., 2009; Fatemi et al., 2018).

The main independent variable is firm ESG performance Dsouza and Krishnamoorthy (2024), captured through the ESG combined

score obtained from the Thomson Reuters database. This score integrates environmental, social, and governance dimensions into a single metric that reflects a firm's overall sustainability engagement. The inclusion of this variable allows the study to explore how ESG performance relates to firm market value in a global context.

Table 1: List of countries

Country	Observations	Percentage
Argentina	26	0.38
Australia	440	6.40
Austria	34	0.49
Belgium	32	0.47
Bermuda	12	0.17
Brazil	98	1.43
Canada	1122	16.33
Chile	38	0.55
China	400	5.82
Colombia	40	0.58
Cyprus	24	0.35
Egypt	2	0.03
Finland	24	0.35
France	144	2.10
Greece	48	0.70
Hong Kong	82	1.19
Hungary	24	0.35
Iceland	4	0.06
India	172	2.50
Indonesia	144	2.10
Israel	24	0.35
Italy	100	1.46
Japan	122	1.78
Jersey	24	0.35
Kazakhstan	2	0.03
Korea; Republic (S. Korea)	58	0.84
Kuwait	2	0.03
Luxembourg	28	0.41
Malaysia	154	2.24
Mexico	6	0.09
Monaco	14	0.20
Mongolia	4	0.06
Morocco	4	0.06
Netherlands	72	1.05
New Zealand	34	0.49
Nigeria	6	0.09
Norway	190	2.76
Pakistan	12	0.17
Philippines	24	0.35
Portugal	22	0.32
Poland	58	0.84
Qatar	42	0.61
Romania	10	0.15
Russia	190	2.76
Saudi Arabia	22	0.32
Singapore	18	0.26
South Africa	26	0.38
Spain	46	0.67
Sweden	20	0.29
Switzerland	24	0.35
Taiwan	24	0.35
Thailand	166	2.42
Turkey	34	0.49
United Arab Emirates	14	0.20
United Kingdom	370	5.38
United States of America	1996	29.05
Total	6872	100.00

To investigate the influence of institutional quality, the study includes three moderating variables: government effectiveness, control of corruption, and regulatory quality. These governance indicators are sourced from the Worldwide Governance Indicators (WGI) and reflect the institutional capacity of countries to formulate and implement sound policies, maintain the rule of law, and control corruption. Prior studies have suggested that the strength of institutional environments can condition the impact of ESG efforts on firm outcomes (Ioannou and Serafeim, 2012; Aguilera et al., 2006).

In addition, a set of control variables is included to mitigate omitted variable bias. These comprise firm-level characteristics such as firm size (measured as the natural logarithm of total assets), leverage (total debt to total assets), and the cash flow ratio. At the macroeconomic level, the study controls for GDP per capita and the SDG Index, both of which may influence firm performance and sustainability practices. These controls are consistent with prior empirical research in ESG and financial performance studies (Cheng et al., 2014; Dhaliwal et al., 2011).

This table defines all variables used in the analysis, including the dependent, independent, moderating, and control variables, along with their measurement methods and sources.

3.2. Regression Model
The conceptual framework illustrated in Figure 1 presents the hypothesized relationships explored in this study. The primary hypothesis (H_1) posits that a firm's Environmental, Social, and Governance (ESG) performance has a direct impact on its market value. In addition to this direct relationship, the framework incorporates three moderating variables Government Effectiveness, Control of Corruption, and Regulatory Quality representing key institutional quality dimensions. Hypotheses H_{2a}, H_{2b}, and H_{2c} suggest that these institutional factors moderate the relationship between ESG performance and market value, potentially strengthening or weakening the observed effect. By integrating these moderating variables, the framework highlights the role of governance and institutional environment in shaping the ESG–market value nexus.

3.3. Model Specifications
To test the proposed hypotheses, this study employs a series of regression models using a two-stage least squares (2SLS)

Figure 1: Research framework hypothesis
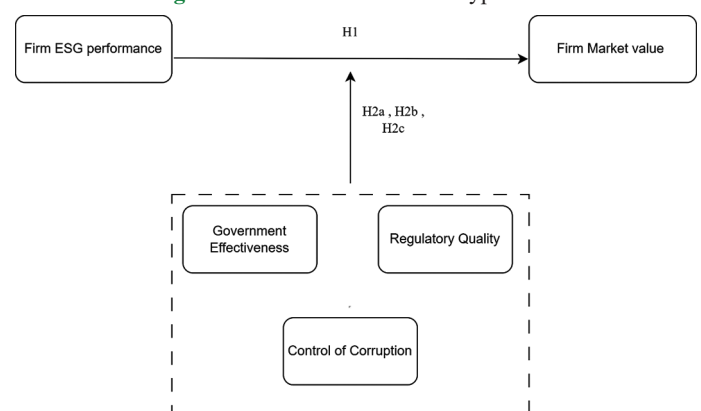
estimation technique to address potential endogeneity concerns.

Model (1) is used to test Hypothesis 1 (H_1), which examines the direct effect of ESG performance on firm market value. The model includes ESG performance as the main independent variable and controls for firm size, leverage, cash flow ratio, GDP per capita, and the SDG Index. Industry and year fixed effects are also included to account for unobserved heterogeneity:

$$Tobinq_{it+1} = \alpha_{10} + \alpha_{11} ESG_{it} + \alpha_{12} Size_{it} + \alpha_{13} Lev_{it} + \alpha_{14} CF_{it} + \alpha_{15} GDP_{it} + \alpha_{16} SDG_{it} + \text{Fixed effects} + \mathcal{E}1_{it} \quad (1)$$

To test the moderating effects of institutional governance quality—Hypotheses H_{2a} to H_{2c}—Models (2) to (4) are estimated by including interaction terms between ESG and each of the governance indicators:

$$Tobinq_{it+1} = \alpha_{20} + \alpha_{21} ESG_{it} + \alpha_{22} govm_{it} + \alpha_{23} ESG^* govm_{it} + \alpha_{24} Size_{it} + \alpha_{25} Lev_{it} + \alpha_{26} CF_{it} + \alpha_{27} GDP_{it} + \alpha_{28} SDG_{it} + \text{Fixed effects} + \mathcal{E}2_{it} \quad (2)$$

$$Tobinq_{it+1} = \alpha_{30} + \alpha_{31} ESG_{it} + \alpha_{32} regq_{it} + \alpha_{33} ESG^* regq_{it} + \alpha_{34} Size_{it} + \alpha_{35} Lev_{it} + \alpha_{36} CF_{it} + \alpha_{37} GDP_{it} + \alpha_{38} SDG_{it} + \text{Fixed effects} + \mathcal{E}3_{it} \quad (3)$$

$$Tobinq_{it+1} = \alpha_{40} + \alpha_{41} ESG_{it} + \alpha_{42} corr_{it} + \alpha_{43} ESG^* corr_{it} + \alpha_{44} Size_{it} + \alpha_{45} Lev_{it} + \alpha_{46} CF_{it} + \alpha_{47} GDP_{it} + \alpha_{48} SDG_{it} + \text{Fixed effects} + \mathcal{E}4_{it} \quad (4)$$

In all models, Tobin's Q is measured at time t+1 to mitigate reverse causality, and control variables are included to account for firm-level and macroeconomic influences. The fixed effects specification controls for industry- and year-specific heterogeneity, enhancing the robustness of the estimated relationships.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics
Table 3 reports the descriptive statistics for all variables used in the empirical analysis over the 2011–2022 period. The average value of Tobin's Q (used to measure firm market value) is 1.281, with a minimum of 0.14 and a maximum of 12.674, indicating considerable variation across firms. The ESG performance variable has a mean of 42.48, ranging from 12.196 to 75.683, suggesting moderate ESG engagement across firms in the sample.

The three moderating variables government effectiveness (Govm), regulatory quality (Regg), and control of corruption (Corr) have mean values of 1.177, 1.138, and 1.037 respectively, with relatively low standard deviations and mild negative skewness, reflecting stable institutional environments in most countries. Firm size (log of total assets) averages 22.211, while leverage (Lev) shows a mean of 0.283 but is highly skewed (9.91) and leptokurtic (kurtosis = 188.24), indicating the presence of extreme debt ratios in some firms.

The cash flow ratio (CF) also displays substantial dispersion, with a mean of 0.059 and extreme values ranging from –6.154 to 1.95. GDP per capita has a mean of 2.395 and a standard deviation of 3.145, while the SDG Index shows a mean of 74.535, with a minimum of 61.741 and a maximum of 81.352. Overall, the statistics indicate that several variables, particularly leverage and cash flow, deviate from normality, justifying the winsorization and robust estimation techniques used in the analysis.

Table 2: Variable definition

Variable types	Variable name	Variable code	Variable definitions
Dependent variable	Firm market value	Tobinq	(Market value of share capital+Market value of net liabilities)/Total assets
Independent variable	Firm ESG performance	ESG	ESG combined score
Moderating variables	Government effectiveness	govm	Governance Dimension
	Regulatory quality	regq	Governance Dimension
	Control of corruption	corr	Governance Dimension
Control variables	Firm scale	Size	The natural logarithm of a company's total assets
	Leverage	Lev	The ratio of total debt to total assets.
	Ratio of total cash assets	CF	Current net cash flow/total assets at year-end
	GDP per capita	GDP	Total output/total population
	SDG index	SDG	SDG index score

Table 3: Descriptive statistics (2011-2022)

Variables	N	Mean	Max	Min	Skewness	Kurtosis	Standard deviation	Median
Tobinq	6872	1.281	12.674	0.14	5.276	49.309	0.807	1.106
ESG	6872	42.48	75.683	12.196	0.078	1.863	19.321	42.566
Govm	6872	1.177	2.285	-1.144	-1.15	3.243	0.628	1.442
Regq	6872	1.138	2.227	-1.156	-1.054	2.758	0.736	1.424
Corr	6872	1.037	2.287	-1.121	-0.826	2.475	0.857	1.293
Size	6872	22.211	27.221	14.154	-0.139	3.157	1.936	22.174
Lev	6872	0.283	7.946	0	9.907	188.241	0.305	0.249
CF	6872	0.059	1.95	-6.154	-10.639	235.124	0.23	0.079
GDP	6844	2.395	11.737	-11.167	-0.813	5.445	3.145	2.294
SDG	6848	74.535	81.352	61.741	-1.13	4.114	4.79	75.583

This table summarizes the central tendency, dispersion, and distributional properties of all variables used in the analysis.

4.2. Correlation Matrix and VIF Values

Table 4 presents the Pearson correlation matrix for all variables used in the study, along with the variance inflation factors (VIF) to assess potential multicollinearity concerns. The correlation between ESG performance and Tobin's Q is negative and statistically significant (r = –0.047, P < 0.01), suggesting a weak inverse relationship between ESG scores and firm market value across the full sample. This finding aligns with prior studies that argue ESG investments may be perceived as costly or long-term by investors, particularly in capital-intensive sectors such as oil and gas (Krüger, 2015).

The three governance quality indicators government effectiveness (Govm), regulatory quality (Regg), and control of corruption (Corr) are strongly interrelated, with correlation coefficients of 0.953, 0.951, and 0.929, all significant at the 1% level. These high correlations reflect the interconnected nature of governance institutions, consistent with their construction under the Worldwide Governance Indicators (Kaufmann et al., 2010). These indicators are also positively associated with the SDG Index, particularly control of corruption (r = 0.601), suggesting that stronger governance environments may be linked to broader sustainable development goals.

In terms of control variables, firm size is negatively correlated with Tobin's Q (r = –0.131, P < 0.01) but positively correlated with ESG performance (r = 0.489, P < 0.01), implying that larger firms tend to have higher ESG scores but lower market valuations, potentially due to agency costs or market expectations. Leverage shows a significant positive relationship with Tobin's Q (r = 0.224, P < 0.01), which may reflect the capital structure characteristics of firms in the resource sector. Cash flow (CF) is positively correlated with ESG (r = 0.116, P < 0.01) and size (r = 0.215, P < 0.01), and negatively correlated with institutional quality variables.

The VIF values, ranging from 1.08 to 1.78, indicate that multicollinearity is not a major issue in the subsequent regression analysis. This confirms the statistical independence of the explanatory variables, despite some conceptual and empirical overlap among the governance indicators. According to O'Brien (2007), VIF values below 5 are generally acceptable, supporting the reliability of the regression estimates.

This table reports Pearson correlation coefficients among all variables and the corresponding VIF values to assess multicollinearity.

4.3. Regression Analyses

Table 5 presents the results of the 2SLS regression models assessing the relationship between ESG performance and firm market value, as proxied by Tobin's Q. In Model 1, ESG performance is positively and significantly associated with Tobin's Q (coefficient = 0.00355, P < 0.01), providing support for Hypothesis 1. This positive relationship remains robust across all models, with slightly larger coefficients in Models 2–4 (0.00941, 0.00683, and 0.00686 respectively; all significant at the 1% level).

Model 2 introduces government effectiveness (Govm) and its interaction with ESG. While the direct effect of Govm is positive and significant (coefficient = 0.207, P < 0.05), the interaction term ESG × Govm is negative and significant (–0.00467, P < 0.01), partially supporting Hypothesis 3a and suggesting that in contexts of higher government effectiveness, the marginal benefit of ESG on firm value is reduced.

In Model 3, regulatory quality (Regg) and its interaction with ESG are included. The interaction term ESG × Regg is negative and statistically significant (–0.00275, P < 0.01), indicating a weakening effect of ESG on market value in stronger regulatory environments. However, the main effect of Regg is positive but not significant (coefficient = 0.157, P > 0.1), providing mixed support for Hypothesis 3c.

Model 4 adds control of corruption (Corr) and its interaction with ESG. Corr shows a positive and significant coefficient (0.233, P < 0.01), supporting Hypothesis 3b, while the interaction term ESG × Corr is negative and significant (–0.00286, P < 0.01), again suggesting that higher institutional strength moderates the positive ESG–value relationship.

Among control variables, firm size consistently shows a negative and highly significant association with Tobin's Q (coefficients between –0.0595 and –0.0616, P < 0.01). Leverage remains positively significant across all models (coefficients between 0.5389 and 0.5473, P < 0.01), while cash flow, GDP per capita, and SDG Index are statistically insignificant in all cases.

Table 4: Correlation (2011-2022)

Variables	Tobinq	ESG	Govm	Regq	corr	Size	Lev	CF	GDP	SDG	VIF
Tobinq	1										
ESG	−0.047***	1									1.37
Govm	0.037***	−0.191***	1								1.59
Regq	0.032***	−0.193***	0.929***	1							1.74
Corr	0.018	−0.188***	0.953***	0.951***	1						1.78
Size	−0.131***	0.489***	−0.230***	−0.285***	−0.250***	1					1.43
Lev	0.224***	0.050***	0.038***	0.030**	0.014	−0.003	1				1.1
CF	0.009	0.116***	−0.102***	−0.115***	−0.099***	0.215***	−0.259***	1			1.15
GDP	0.038***	−0.009	−0.192***	−0.216***	−0.209***	0.037***	−0.062***	0.137***	1		1.08
SDG	−0.128***	0.047***	0.545***	0.578***	0.601***	−0.054***	−0.088***	−0.005	−0.215***	1	1.69

***P<0.01, **P<0.05, *P<0.1

Table 5: Two-stage least squares (2SLS) regression analysis results of Models (1) to (4) (2011-2022)

Variables	Model 1	Model 2	Model 3	Model 4
	Tobinq t+1	Tobinq t+1	Tobinq t+1	Tobinq t+1
ESG	0.00355***	0.00941***	0.00683***	0.00668***
	(0.0008)	(0.0022)	(0.0017)	(0.0014)
Govm	-	0.207**	-	-
	-	(0.1050)	-	-
ESG* govm	-	−0.00476***	-	-
	-	(0.0015)	-	-
Regq	-	-	0.157	-
	-	-	(0.1020)	-
ESG* regq	-	-	−0.00275**	-
	-	-	(0.0011)	-
Corr	-	-	-	0.233**
	-	-	-	(0.0980)
ESG* corr	-	-	-	−0.00286***
	-	-	-	(0.0009)
Size	−0.0616***	−0.0586***	−0.0595***	−0.0594***
	(0.0072)	(0.0071)	(0.0071)	(0.0071)
Lev	0.538***	0.542***	0.543***	0.543***
	(0.0325)	(0.0325)	(0.0325)	(0.0325)
CF	−0.0366	−0.0381	−0.0329	−0.0378
	(0.0430)	(0.0430)	(0.0431)	(0.0430)
GDP	0.00462	0.00345	0.00376	0.00493
	(0.0062)	(0.0062)	(0.0062)	(0.0062)
SDG	0.0184	0.00493	0.00765	0.000372
	(0.0173)	(0.0194)	(0.0179)	(0.0182)
Constant	0.788	1.455	1.403	1.9
	(1.2360)	(1.3770)	(1.2690)	(1.2970)
Controls year effect	Yes	Yes	Yes	Yes
Controls country effect	Yes	Yes	Yes	Yes
Anderson canon. corr. LM statistic=P value	0.000	0.0000	0.0000	0.000
Durbin-Wu-Hausman=P value	0.026	0.020	0.0237	0.0218
Sargan statistic=P value	0.272	0.534	0.4924	0.4811
Pagan-Hall general test statistic=P value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

Instrumental validity tests are reported at the bottom of the table. The Anderson canonical correlation LM statistic and Pagan–Hall general test statistic are significant (p = 0.0000), confirming instrument relevance and model identification. The Durbin–Wu–Hausman test for endogeneity yields p-values ranging from 0.020 to 0.232, indicating model robustness. All Sargan statistics are insignificant (P > 0.10), confirming that the instruments used are valid and uncorrelated with the error term.

This table reports the results of 2SLS regressions examining the impact of ESG performance on firm market value, along with the moderating effects of government effectiveness, regulatory quality, and control of corruption. Standard errors are reported in parentheses, and significance levels are indicated.

Table 6 presents the results of the 2SLS regression analysis for the pre-COP21 period (2011–2016), examining the relationship between ESG performance and firm market value (Tobin's Q), and the moderating role of institutional governance indicators. Across all four models, ESG performance shows no statistically significant effect on Tobin's Q, with coefficients ranging from –0.0171 in Model 1 to 0.000893 in Model 4 (all P > 0.10). This suggests that prior to COP21, ESG efforts were not yet valued by markets in the global oil and gas sector.

In Model 2, government effectiveness (Govm) exhibits a positive and statistically significant coefficient (0.266, P < 0.01), but its interaction with ESG (ESG × Govm) is not significant. Model 3 reveals that regulatory quality (Regg) is marginally significant (0.135, P < 0.10), while the ESG interaction term remains insignificant. In contrast, Model 4 shows a significant and positive effect of control of corruption (Corr) on firm market value (coefficient = 0.182, P < 0.01), although the ESG × Corr interaction remains insignificant, suggesting the market did not price ESG differently in stronger anti-corruption contexts during this early period.

Among the control variables, leverage (Lev) is consistently and positively significant across all models, with coefficients ranging from 0.729 to 0.832 (P < 0.01), reinforcing the role of debt in supporting firm value during the pre-COP21 years. Cash flow (CF) shows a strong negative effect on Tobin's Q across all models (e.g., –0.239 in Model 1 to –0.305 in Model 4, all P < 0.01), which may reflect operational volatility or investor caution around internal financing. Firm size, GDP per capita, and SDG Index are statistically insignificant.

All models pass the instrumental validity checks. The Anderson LM statistic and Pagan–Hall test are strongly significant (p = 0.0000), confirming model identification and instrument

Table 6: Two-Stage least squares (2SLS) regression analysis results of Models (1) to (4) (2011-2016) Pre COP21

Variables	Model 1	Model 2	Model 3	Model 4
	Tobinq t+1	Tobinq t+1	Tobinq t+1	Tobinq t+1
ESG	−0.0171	0.00182	−0.0014	0.000893
	(0.0115)	(0.0027)	(0.0025)	(0.0020)
Govm	-	0.266***	-	-
	-	(0.0959)	-	-
ESG* govm	-	−0.00121	-	-
	-	(0.0019)	-	-
Regq	-	-	0.135*	-
	-	-	(0.0811)	-
ESG* regq	-	-	0.00107	-
	-	-	(0.0018)	-
Corr	-	-	-	0.182***
	-	-	-	(0.0665)
ESG* corr	-	-	-	−0.000746
	-	-	-	(0.0013)
Size	0.0659	0.00197	0.00685	0.00585
	(0.0720)	(0.0146)	(0.0148)	(0.0148)
Lev	0.729***	0.800***	0.817***	0.832***
	(0.0952)	(0.1030)	(0.1040)	(0.1040)
CF	−0.239***	−0.309***	−0.300***	−0.305***
	(0.0712)	(0.0637)	(0.0641)	(0.0639)
GDP	−0.0303*	−0.0115	−0.00437	−0.00928
	(0.0158)	(0.0113)	(0.0113)	(0.0113)
SDG	−0.0607	−0.0389***	−0.0379***	−0.0387***
	(0.0387)	(0.0054)	(0.0054)	(0.0055)
Constant	4.551	3.434***	3.420***	3.451***
	(3.6290)	(0.5290)	(0.5270)	(0.5120)
Controls year effect	No	Yes	Yes	Yes
Controls country effect	Yes	No	No	No
Anderson canon. corr. LM statistic=P value	0.000	0.0000	0.0000	0.000
Durbin-Wu-Hausman=P value	0.044	0.038	0.0326	0.0579
Sargan statistic=P value	0.761	0.384	0.2342	0.4631
Pagan-Hall general test statistic=P value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

relevance. The Durbin–Wu–Hausman test results range from p = 0.038 to 0.579, suggesting the appropriateness of the 2SLS approach. Sargan tests are all insignificant, supporting the validity of the instruments used.

This table reports 2SLS regression results for the 2011–2016 period, assessing ESG's impact on firm value and the moderating role of institutional governance before the COP21 agreement.

Table 7 reports the results of the 2SLS regression analysis for the post-COP21 period (2017–2022), examining the relationship between ESG performance and firm market value, with attention to institutional moderators. In Model 1, ESG performance has a positive and statistically significant effect on firm market value (coefficient = 0.00336, P < 0.01), and this relationship remains robust across Models 2–4, with coefficients of 0.00852, 0.00800, and 0.00600 respectively (all P < 0.01). These findings indicate that following the COP21 agreement, ESG performance became a more relevant value driver in the oil and gas sector, supporting Hypothesis 1.

In Model 2, government effectiveness (Govm) has a positive and significant effect (0.405, P < 0.05), while the interaction term ESG × Govm is negative and significant (–0.00445, P < 0.01), suggesting that while strong governance environments are valued,

they may dampen the incremental value of ESG initiatives (Hypothesis 3a). Model 3 shows that regulatory quality (Regg) is positively and significantly related to firm value (0.366, P < 0.01), while ESG × Regg is negatively associated (–0.00315, P < 0.01), providing support for Hypothesis 3c. In Model 4, control of corruption (Corr) is negative but statistically insignificant (–0.135, P > 0.1), while the interaction term ESG × Corr remains negative and significant (–0.00367, P < 0.01), confirming Hypothesis 3b.

Among the control variables, firm size is negatively associated with Tobin's Q across all models (coefficients range from –0.063 to –0.0665, all P < 0.01). Leverage is positively significant throughout (0.541–0.546, P < 0.01), while cash flow (CF) shows no statistical significance. GDP per capita is weakly significant in Model 1 (0.0925, P < 0.1) and loses significance in other models. The SDG Index is positively significant in all models (0.115–0.119, P < 0.01), suggesting that countries with stronger sustainability agendas positively influence firm valuation in this sector.

Instrumental validity tests confirm model reliability. The Anderson LM statistic and Pagan–Hall test are significant at p = 0.0000 in all models, verifying instrument relevance and identification. The Durbin–Wu–Hausman test p-values range from 0.010 to 0.031, supporting the use of 2SLS. The Sargan test is insignificant in all cases (P > 0.10), confirming the validity of the instruments used.

Table 7: Two-stage least squares (2SLS) regression analysis results of Models (1) to (4) (2017-2022) Post COP21

Variables	Model 1	Model 2	Model 3	Model 4
	Tobinq t+1	Tobinq t+1	Tobinq t+1	Tobinq t+1
ESG	0.00336***	0.00882**	0.00709***	0.00600***
	(0.0012)	(0.0039)	(0.0027)	(0.0022)
Govm	-	0.408*	-	-
	-	(0.2310)	-	-
ESG* govm	-	−0.00445	-	-
	-	(0.0027)	-	-
Regq	-	-	0.366**	-
	-	-	(0.1750)	-
ESG* regq	-	-	−0.00315*	-
	-	-	(0.0017)	-
Corr	-	-	-	−0.135
	-	-	-	(0.2110)
ESG* corr	-	-	-	−0.00266*
	-	-	-	(0.0015)
Size	−0.0683***	−0.0665***	−0.0667***	−0.0665***
	(0.0106)	(0.0103)	(0.0104)	(0.0104)
Lev	0.504***	0.505***	0.507***	0.505***
	(0.0536)	(0.0536)	(0.0536)	(0.0536)
CF	0.128	0.136*	0.133*	0.138*
	(0.0783)	(0.0786)	(0.0785)	(0.0785)
GDP	0.00925	0.01	0.0102	0.00726
	(0.0084)	(0.0085)	(0.0085)	(0.0084)
SDG	0.138**	0.166**	0.142**	0.0996
	(0.0626)	(0.0676)	(0.0626)	(0.0682)
Constant	−8.007*	−10.25**	−8.346*	−5.375
	(4.5330)	(4.8840)	(4.5360)	(4.9250)
Controls year effect	Yes	Yes	Yes	Yes
Controls country effect	Yes	Yes	Yes	Yes
Anderson canon. corr. LM statistic=P value	0.000	0.0000	0.0000	0.000
Durbin-Wu-Hausman=P value	0.014	0.013	0.0119	0.0135
Sargan statistic=P value	0.125	0.136	0.1409	0.1425
Pagan-Hall general test statistic=P value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

This table shows post-COP21 2SLS regression results (2017–2022), highlighting the impact of ESG on firm value and the moderating role of institutional governance quality.

4.4. Robustness Test

Table 8 presents robustness checks using a restricted sample of G7 countries for the pre-COP21 period (2011–2016). The models replicate the 2SLS regressions to evaluate whether the relationship between ESG performance and firm market value (Tobin's Q) remains consistent in more developed economies.

In Model 1, ESG performance is negative and statistically insignificant (–0.0181, P > 0.1), suggesting no firm value premium for ESG engagement during this early period. Model 2 reports a statistically significant and positive coefficient for ESG (0.0341, P < 0.1), but the effect disappears in Models 3 and 4. Across Models 2–4, the interaction terms with institutional variables (ESG × Govm, ESG × Regg, ESG × Corr) are all insignificant, and their corresponding main effects (e.g., Govm = –0.236, Regg = –1.1, Corr = –1.023) are not statistically significant, offering no support for Hypotheses 3a–3c in the G7 pre-COP21 context.

Among the control variables, firm size has mixed significance: it is not significant in Model 1 but turns negative and statistically significant in Models 2 and 3 (–0.0562 and –0.0633, both P < 0.01). Leverage remains consistently and positively significant across all

models (e.g., 0.482 in Model 1 to 0.5077 in Model 4, all P < 0.05), reinforcing its positive association with firm market value in developed economies. Cash flow (CF) shows a strong positive effect in all models (e.g., 1.267 to 1.269, P < 0.01), contrasting with earlier full-sample findings. SDG Index is negative and statistically significant in Models 2–4 (e.g., –0.0646, –0.0541, –0.0591, all P < 0.05), suggesting that stronger sustainability agendas may not align with market value in this period.

All models pass the core diagnostic checks for instrument validity. The Anderson canonical correlation LM statistic and Pagan–Hall general test statistic are significant (p = 0.000), confirming instrument relevance and identification. The Durbin–Wu–Hausman test supports endogeneity treatment, with p-values ranging from 0.041 to 0.051. All Sargan tests are insignificant (P > 0.10), confirming that the instruments used are valid.

Two-Stage least squares (2SLS) regression analysis results of Models (1) to (4) (G7 2011-2016) Pre COP21

Table 9 presents the results of the 2SLS regression analysis conducted for G7 countries during the post-COP21 period (2017–2022). The analysis investigates the relationship between ESG performance and firm market value (Tobin's Q), and how this relationship is influenced by institutional governance indicators.

Table 8: Robustness test

Variables	Model 1	Model 2	Model 3	Model 4
	Tobinq t+1	Tobinq t+1	Tobinq t+1	Tobinq t+1
ESG	−0.0181	0.0341*	0.024	0.0639*
	(0.0125)	(0.0206)	(0.0192)	(0.0366)
Govm	-	1.207*	-	-
	-	(0.7260)	-	-
ESG* govm	-	−0.0201	-	-
	-	(0.0126)	-	-
Regq	-	-	−1.1	-
	-	-	(0.9230)	-
ESG* regq	-	-	−0.0142	-
	-	-	(0.0124)	-
Corr	-	-	-	−1.023
	-	-	-	(3.2490)
ESG* corr	-	-	-	−0.0380*
	-	-	-	(0.0218)
Size	0.0785	−0.0562***	−0.0633***	−0.0562*
	(0.0860)	(0.0182)	(0.0190)	(0.0300)
Lev	0.482***	0.514***	0.583***	0.077
	(0.1630)	(0.1470)	(0.1550)	(0.2080)
CF	1.267***	1.628***	1.694***	1.360***
	(0.3070)	(0.2030)	(0.2050)	(0.2640)
GDP	−0.0357	−0.00537	0.0257	−0.192
	(0.0491)	(0.0321)	(0.0515)	(0.1720)
SDG	−0.244	−0.0646***	−0.0491	−0.911
	(0.2320)	(0.0140)	(0.2150)	(0.7790)
Constant	18.7	5.233***	8.127	74.51
	(17.5700)	(1.2140)	(16.5200)	(65.0800)
Controls year effect	Yes	Yes	Yes	Yes
Controls country effect	Yes	No	Yes	Yes
Anderson canon. corr. LM statistic=P value	0.000	0.000	0.000	0.000
Durbin-Wu-Hausman=P value	0.051	0.041	0.0812	0.0243
Sargan statistic=P value	0.163	0.395	0.3381	0.0962
Pagan-Hall general test statistic=P value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

Table 9: Two-stage least squares (2SLS) regression analysis results of Models (1) to (4) (G7 2017-2022) Post COP21

Variables	Model 1	Model 2	Model 3	Model 4
	Tobinq t+1	Tobinq t+1	Tobinq t+1	Tobinq t+1
ESG	0.00651***	0.0998***	0.102***	0.0373***
	(0.0015)	(0.0357)	(0.0352)	(0.0114)
Govm	-	3.803***	-	-
	-	(1.2700)	-	-
ESG* govm	-	−0.0662***	-	-
	-	(0.0247)	-	-
Regq	-	-	3.115***	-
	-	-	(1.1090)	-
ESG* regq	-	-	−0.0657***	-
	-	-	(0.0237)	-
Corr	-	-	-	0.500
	-	-	-	(0.5680)
ESG* corr	-	-	-	−0.0241***
	-	-	-	(0.0083)
Size	−0.0745***	−0.0611***	−0.0683***	−0.0732***
	(0.0134)	(0.0132)	(0.0135)	(0.0135)
Lev	0.314***	0.252***	0.218**	0.265***
	(0.0867)	(0.0938)	(0.0980)	(0.0898)
CF	0.280***	0.296***	0.279***	0.279***
	(0.0958)	(0.0998)	(0.0997)	(0.0968)
GDP	−0.00583	0.00509	0.00217	−0.0057
	(0.0156)	(0.0175)	(0.0172)	(0.0158)
SDG	0.123	0.317**	0.191*	0.0127
	(0.1080)	(0.1450)	(0.1160)	(0.1290)
Constant	−7.17	−28.23**	−17.25*	0.968
	(8.3600)	(12.3600)	(9.3960)	(10.4200)
Controls year effect	Yes	Yes	Yes	Yes
Controls country effect	Yes	Yes	Yes	Yes
Anderson canon. corr. LM statistic=P value	0.000	0.0000	0.0000	0.000
Durbin-Wu-Hausman=P value	0.002	0.005	0.0051	0.005
Sargan statistic=P value	0.377	0.206	0.1843	0.1989
Pagan-Hall general test statistic=P value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1

Across all models, ESG performance is positive and statistically significant, indicating that post-COP21, ESG activities were increasingly valued by investors in advanced economies. Specifically, ESG coefficients are 0.00635 (Model 1), 0.00995 (Model 2), 0.0102 (Model 3), and 0.00377 (Model 4), all significant at the 1% level. These findings strongly support Hypothesis 1 and demonstrate enhanced market appreciation for ESG in the post-agreement phase.

In terms of moderating effects, Model 2 shows that government effectiveness (Govm) is positively significant (coefficient = 3.803, P < 0.01), while the interaction term ESG × Govm is negative and significant (–0.0652, P < 0.01), suggesting that while institutional strength boosts firm value, it may reduce the marginal benefit of ESG engagement (Hypothesis 3a). Model 3 presents a similar pattern for regulatory quality (Regg), which is highly significant (3.115, P < 0.01), while the ESG × Regg interaction is negative and significant (–0.0657, P < 0.01), supporting Hypothesis 3c. Model 4 finds that control of corruption (Corr) has no direct significance (0.500, P > 0.1), but the ESG × Corr term is negative and significant (–0.0247, P < 0.01), lending support to Hypothesis 3b.

Regarding control variables, firm size is consistently negative and significant across all models (e.g., –0.0475 to –0.0637, P < 0.01), indicating that larger firms may face lower market valuation multiples. Leverage remains positively significant in all models (0.531–0.553, P < 0.01), while cash flow (CF) has no significant effect on firm value. GDP per capita is insignificant across all models. The SDG Index is positively and significantly related to Tobin's Q in every model (coefficients between 0.0150 and 0.0175, P < 0.01), reinforcing the growing importance of sustainable development orientation in advanced economies post-COP21.

All instrumental diagnostics confirm model validity. The Anderson canonical correlation LM statistic and Pagan–Hall test are significant at p = 0.000 in all models, confirming instrument relevance and proper model identification. The Durbin–Wu–Hausman tests are significant in all models (p-values from 0.002 to 0.026), indicating endogeneity concerns are appropriately addressed. The Sargan tests are insignificant across all models (P > 0.10), validating the exogeneity of instruments.

This table presents 2SLS regression results for G7 countries post-COP21, examining the impact of ESG performance on firm value and the moderating role of governance quality from 2017 to 2022.

5. CONCLUSION, IMPLICATIONS AND FUTURE RESEARCH

This study investigated the relationship between ESG performance and firm market value, focusing on a comprehensive global panel of oil and gas sector firms. The dataset comprised 6,872 firm-year observations from 934 firms across 52 countries for the period 2011–2022, drawn from the Thomson Reuters database. The analysis applied a two-stage least squares (2SLS) regression framework to address potential endogeneity concerns and explored the moderating effects of three institutional quality indicators:

government effectiveness, regulatory quality, and control of corruption.

The findings provide robust support for the central hypothesis that ESG performance positively influences firm market value, particularly in the post-COP21 period (2017–2022). This relationship was weak or insignificant before COP21, especially in the G7 sample, but became consistently significant in the post-agreement years. The shift suggests that global climate initiatives and regulatory shifts after COP21 increased investor sensitivity to ESG-related disclosures and practices.

Importantly, the study reveals that institutional governance quality significantly moderates the ESG–value relationship. Across multiple model specifications, government effectiveness, regulatory quality, and control of corruption showed positive direct effects on firm value. However, their interaction with ESG performance was consistently negative and significant, indicating a diminishing marginal value of ESG in stronger institutional environments. These results imply that ESG investments may substitute for weak governance in some contexts but are less critical in settings with robust institutional frameworks.

From a theoretical perspective, the study contributes to the literature by demonstrating the conditional effect of institutional quality on the ESG–firm value link. It supports the view that ESG is not universally valued in the same way, but rather its benefits depend on the broader governance environment. This adds nuance to stakeholder and legitimacy theories in the context of ESG disclosure and firm valuation.

From a practical standpoint, the findings carry important implications for managers, investors, and policymakers. Firms operating in countries with weaker institutions may derive greater reputational or strategic benefit from proactive ESG practices, while in strong-governance countries, ESG may be seen as an expected standard. Investors should incorporate country-level institutional quality into ESG valuation models, while regulators should recognize that uniform global ESG mandates may produce uneven impacts depending on local governance conditions.

Future studies could extend this research by exploring the individual components of ESG (environmental, social, and governance scores) to determine which dimension drives firm value in different institutional contexts. Additionally, researchers could incorporate firm-level governance mechanisms (e.g., board composition, ownership concentration) to assess how internal and external governance interact in shaping ESG outcomes. Finally, longitudinal qualitative case studies could complement these findings by exploring how firms strategically adapt ESG strategies in response to institutional and regulatory pressures.

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