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Gender Diversity and Corporate Sustainability: Evidence from ESG Risk Scores of S&P 500 Firms

Dr Hassan Raza and Dr Shumaila Zeb[*]

ABSTRACT

This study aims to achieve two main goals. The first goal is to analyse the relationship between the firm's performance, revenue growth, and size, on one hand, and the firm's environmental, social and governance (ESG) scores, on the other. Second, it seeks to determine whether this relationship between firm performance and ESG risk scores is moderated by the presence of a female chief executive officer (CEO), on a sample of 426 S&P 500 firms. The study uses descriptive statistics, correlation, and ordinary least squares (OLS) regression with Python. The results indicate that ESG risk scores have a strong positive association with firm performance; and that firms with better financial performance have better sustainability practices. Similarly, the relationship between firm performance and ESG risk score is significantly enhanced in the presence of a female CEO. However, the impact of a female CEO varies, suggesting that the effect of gender diversity on a firm's sustainability depends on firm-specific factors, including size and performance. These findings highlight that corporate sustainability emphasises the value of increasing gender diversity and incorporating sustainability goals within corporations' governance frameworks. Furthermore, this study proposes enhancing gender diversity and aligning the firm's sustainability objectives more effectively with its overall goals to improve societal and corporate outcomes.

Keywords: Firm Performance, ESG Risk Scores, Corporate Sustainability, Leadership, Female CEO

JEL Classification Codes: G3, G38, G39

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1. INTRODUCTION

In the contemporary business world, incorporating environmental, social, and governance (ESG) principles and practices into corporate strategies is increasingly recognised as an important factor influencing firms' performance and social image. All stakeholders of a firm, including its investors and customers, are placing greater importance on corporate sustainability. Prior studies show that firms are increasingly adopting frameworks to comply with policy and regulatory requirements and meet the ever-changing corporate sustainability expectations of stakeholders (Khan et al., 2023; Baumüller and Sopp 2022; Talha 2026). These studies emphasise the importance of incorporating sustainability into core firm strategies, ensuring that the firm's operations are aligned with overall societal goals, such as those of the United Nations Sustainable Development Goals (SDGs) (Putri and Pratama 2023).

Strong ESG practices are reflected in lower ESG risk scores, which signal that a firm is managing its sustainability exposure proactively (Stewart 2026). However, the literature indicates that firms with high valuations have more growth opportunities, with greater investments in ESG principles, potentially resulting in high ESG risk scores (Lin 2026).

Moreover, at the chief executive officer (CEO) level, gender diversity in leadership positions influences risk management styles and corporate behaviour in firms. ESG concerns are usually uniquely affected by female CEOs' leadership styles and perspectives (Chen et al., 2025). Prior research supports the claim that female CEOs lead to more cautious decision-making, especially given that risk assessment is vital in corporate environments. For instance, a previous study shows that firms with female CEOs, who are generally risk-averse, benefit from safeguarding strategies that improve firm performance (Yadav and Prashar 2023). Female CEOs exhibit a risk-averse approach when responding to stock options, reaffirming that corporate strategies are guided by cautious decision-making (Gomez-Mejia et al., 2019). Similarly, past studies emphasise that female CEOs have a greater preference to reduce corporate risk. Their findings further suggest that risk tolerance is affected by executives' gender (Faccio et al., 2016; Chan et al., 2026).

Despite the extensive adoption of ESG principles, significant gaps remain in assessing the overall impact of characteristics beyond firm performance on ESG risk scores. Existing literature mostly focuses on the overall implications of ESG without exploring how executive characteristics, such as the presence of a female CEO, may play a significant role in shaping these outcomes. As a result, little is known about how gender-diverse leadership shapes ESG effectiveness and strategic alignment (Issa 2023; Aguirre-Pérez and García-Sánchez 2025). This gap in the literature is more evident for companies listed in the S&P 500 index. These firms are under immense pressure to align their operations with ESG principles and practices. Strong ESG alignment supports both corporate image and long-term sustainability (Sutisman et al., 2024; Alghamdi and Agag 2023; Alrashed et al., 2026). This paper addresses this research gap by examining how firm size, firm performance, and

revenue growth affect ESG risk scores and by investigating how the role of a female CEO influences the relationship between firm-level performance and ESG risk scores.

This study asks two research questions.

> **RQ1:** How do firm performance, firm size, and revenue growth affect the ESG risk scores of S&P 500 firms?
>
> **RQ2:** Does the presence of a female CEO moderate the relationship between firm performance and ESG risk scores? Both questions follow from the gap identified above, since prior work has rarely examined whether the CEO's gender affects how financial performance translates into sustainability outcomes.

The study estimates ordinary least squares (OLS) regression models to answer these questions. The dependent variables are the ESG risk scores, which are the total score and the environmental, social, and governance scores. Firm performance (Tobin's Q) is the main independent variable; firm size and firm revenue growth are control variables, and the moderator is the female CEO indicator.

This study is significant for theory, method, and practice. On the theory side, it builds on agency and stakeholder arguments on gender diversity on boards (Setó-Pamies 2015) and examines whether female leadership transforms the association between financial performance and sustainability results, instead of just the extent of the results. This study does not use traditional ESG ratings but instead uses ESG risk scores, with lower scores indicating better management of sustainability risk, and treats the female CEO as a moderator rather than a predictor. The results provide boards, investors, and regulators with evidence that having a woman in the top executive position is correlated with lower environmental, social, and governance risk, an issue that is important for S&P 500 companies that are increasingly subject to disclosure mandates (Romano et al., 2020; Wan Ismail et al., 2026).

2. LITERATURE REVIEW

In prior studies, firm performance is increasingly linked to sustainable practices adopted by the firm. For example, Medcalfe and Miralles Miro (2022) suggested a positive correlation between firm performance and sustainability practices (Alrashed et al., 2026). Firm size plays a vital role in the adoption of sustainability initiatives, as larger firms have greater resources to implement sustainability practices. In another study, Keskin et al. (2020) observed that larger firms are more likely to engage in sustainability initiatives (Solimene et al., 2025). On the contrary, the incorporation of sustainability in the firm's strategies not only aligns with firm performance but also enhances social and environmental responsibilities (Orazalin and Mahmood 2021; Saini et al., 2025).

Evidence based on ESG risk scores points in the same direction. Shahrun et al. (2023) link environmental, social, and governance criteria to the corporate value of listed Malaysian companies, while Yudhanto and Simamora (2023) report that ESG risk affects firm

performance, in part, through firm risk; Shobhwani and Lodha (2023) study the same question for NSE-100 companies (Stewart 2026). Revenue growth has received less attention in this literature. Growing firms have more resources to invest in sustainability programmes, but rapid expansion can also pull management attention away from ESG concerns (Dewi and Wijaya 2021), so the direction of the effect remains an empirical question.

The role of gender diversity in firm leadership has received significant attention in recent years, especially the effects of firm practices on ESG outcomes. Recent studies consistently demonstrate that firms with gender diversity on the board have higher ESG risk scores and better sustainability performance (Saleh and Maigoshi 2025; Agustina and Barokah 2024; Mnasri et al., 2025; Zhu and Chen 2025). The theoretical framework that supports this study is agency theory, suggesting that gender diversity on the board increases corporate insight and balances opportunistic behaviour, fostering sustainability in the firm. Stakeholder theory shows that such boards, with greater understanding of stakeholder concerns, lead to improvements in a firm's ESG practices and policies, resulting in more efficient sustainability strategies (Setó-Pamies 2015; Pernamasari 2025).

Gender diversity across the board has led to legislative actions in countries such as Sweden and Norway, making it necessary for companies to increase the representation of women on boards and in overall leadership positions (Fernández-Méndez and Pathan 2025). This shift in global trends is reaffirmed by a variety of studies, which show that female CEOs and directors, by prioritising social and environmental concerns, can amplify the positive impact of size and firm performance on the initiation of sustainability practices (Scafarto et al., 2025). Similarly, prior literature suggests that female CEOs usually increase corporate sustainability disclosure, indicating a better ethical orientation and concern for the corporation's social performance compared with male CEOs (Ahmed et al., 2024; Boța-Avram and Tiron-Tudor 2025). This is also supported by another study that says firms managed by female CEOs are more likely to implement sustainable environmental practices and policies, reflecting their risk-averse attitude and commitment to reducing the possibility of controversies regarding unsustainable practices (Zhang et al., 2023; Chen et al., 2025). Critical mass theory suggests that the impact of female executives on performance is linked to their representation beyond a token level to when it is meaningful (Buchdadi et al., 2023; Najaf et al., 2025). It is also found that the characteristics of the CEO can influence sustainability disclosure, which indicates that the study should examine the role of the CEO, instead of the board (Hussain et al., 2023; Mei et al., 2025).

Moreover, evidence that female CEOs promote ethical governance and accountability culture reinforces the firm's transparency in managing environmental risk and its female leadership. The results suggest that boards of firms with female representation are more concerned with environmental risks and opportunities, which leads to improved overall company performance (de Villiers et al., 2011; Gull et al., 2026). This proactive approach is crucial in the business world, where stakeholders' expectations regarding sustainability

and corporate responsibility are increasingly important. Wong et al. (2022) add that ESG performance rewards continuous improvement rather than one-off initiatives, so top leadership's commitment must be sustained over time.

The above-mentioned studies suggest that gender equality highlights the role of women in corporate environmental and social disclosure, showing their vital role in initiatives taken for sustainability developments (Arora et al., 2025). This developing discussion is vital for policymakers, regulators, and managers seeking to enhance ESG performance by leveraging gender diversity in corporate leadership, thereby advancing the literature on firm performance and sustainability. Prior literature also shows the need for evidence on the role of female CEOs in the relationship between ESG risk scores and firm performance.

The studies reviewed above support four testable hypotheses. Firms with stronger market performance face higher stakeholder expectations and have more resources for sustainability programmes (Medcalfe and Miralles Miro 2022; Yu et al., 2018; Alrashed et al., 2026), although highly valued firms may also carry greater exposure to ESG-related risk. Larger firms attract more scrutiny and tend to keep more formal governance structures (Keskin et al., 2020; Galbreath 2018; Solimene et al., 2025), while growth changes the resources available for sustainability spending (Dewi and Wijaya 2021). Evidence on female leadership and risk aversion (Faccio et al., 2016; Zhang et al., 2023; Chen et al., 2025) suggests that a female CEO alters the way financial performance translates into sustainability outcomes. The hypotheses are:

H1: Firm performance (Tobin's Q) has a negative and significant effect on ESG risk scores.

H2: Firm size has a negative and significant effect on ESG risk scores.

H3: Revenue growth has a positive and significant effect on ESG risk scores.

H4: The presence of a female CEO positively moderates the relationship between firm performance and ESG risk scores.

3. RESEARCH METHODOLOGY

3.1 Data Description and Sample Selection

This study uses secondary data collected from publicly traded companies listed in the S&P 500 index. The data covers the 2023–24 period for a total of 426 firms. Data is collected from sustainability reports, financial statements, and other publicly available resources. The market valuation metrics and financial data were collected from databases such as Thomson Reuters, Bloomberg, LSEG Data Stream, and S&P Capital IQ. Sustainability metrics, particularly ESG risk scores, were collected from databases, including the Morgan Stanley Capital International (MSCI) ESG ratings. The 426 publicly traded firms listed on the S&P 500 index are used as the sample for this study. A comprehensive sample was collected across various industries to ensure diverse representation of data. Because of the diverse

sample, the findings can be generalised across a broad corporate spectrum. The dataset is cross-sectional as it pertains to a single year.

3.2 Variables Description

ESG risk scores are used to measure corporate sustainability. ESG risk scores are divided into three parts: Environmental, Social, and Governance. All elements of an ESG risk score stem from a firm's dedication to sustainable practices. Higher ESG risk scores are associated with lower financial results and better risk management, and a robust connection between corporate performance and sustainability.

In this study, the dependent variables are ESG-related risk scores, which represent various aspects of the firm's sustainability. The Total ESG Risk Score is a composite score which combines risks across the three key areas of ESG: environmental, social and governance. This composite score reflects the firm's exposure to sustainability risk factors and its overall ESG performance.

The Environmental Risk Score measures a company's environmental impact and responsibilities, reflecting its dedication to safeguarding environmental resources and reducing environmental damage. The Social Risk Score quantifies a company's impact on society, encompassing factors like gender diversity, employee well-being, and community engagement. Meanwhile, the Governance Risk Score assesses the firm's ethical standards, transparency, and governance quality, all of which are critical in determining the firm's long-term sustainability and viability (Korkmaz and Nur 2023; Stewart 2026).

In this study, the major independent variable is firm performance, measured by Tobin's Q. It measures a business's performance relative to its replacement cost. This measure indicates the efficiency and effectiveness of the firm in using its assets and provides an indication of the value placed by the market on the firm's future growth opportunities (Hamdan et al., 2022).

The study controls several firm-specific characteristics that could affect the ESG risk scores. Firm size is proxied by the log of total assets, indicating a firm's capacity and scale of operation. Sustainability management may be more heavily affected by larger firms, which may be more subject to stakeholder scrutiny and more resourceful. In addition, revenue growth is incorporated as a control variable to account for the firm's financial dynamics and growth path. Revenue growth is the increase in revenue over a period, indicating how fast a company is growing and expanding its market share (Dewi and Wijaya 2021).

3.3 Econometric Models

This study used a quantitative research design, applying inferential and descriptive statistical methods to achieve the research objectives. An OLS regression framework is used to evaluate the impact of financial metrics and firm characteristics on ESG risk scores. The model is repeated for each dimension of ESG risk scores, including environment,

social, and governance risk scores. Each model regresses one ESG dimension on the independent and control variables.

The following are the econometric models used by this study:

$$\text{ESGRiskScores}_i = \beta_0 + \beta_1 \text{TobinsQ}_i + \beta_2 \text{FirmSize}_i + \beta_3 \text{Female CEO}_i + \beta_4 \text{RevenueG}_i + \mu_i \quad (1)$$

$$\text{ESGRiskScores}_i = \Upsilon_0 + \Upsilon_1 \text{TobinsQ}_i + \Upsilon_2 \text{FirmSize}_i + \Upsilon_3 \text{Female CEO}_i + \Upsilon_4 \text{RevenueG}_i + \Upsilon_5 \text{Female CEO} * \text{TobinsQ}_i + \epsilon_i \quad (2)$$

In Equation (1), ESG Risk Scores refers to the total ESG risk score of firms i, or to one of its environmental, social, or governance components. Tobin's Q measures firm performance, Firm Size is the logarithm of total assets, Female CEO is a dummy variable equal to one when the firm's CEO is a woman, and Revenue G is annual revenue growth; β0 is the intercept and ε the error term. Equation (2) adds the interaction term Female CEO × Tobin's Q, which captures the moderating effect tested in H4. Each hypothesis is tested through t-tests on the estimated coefficients at the 1%, 5%, and 10% significance levels.

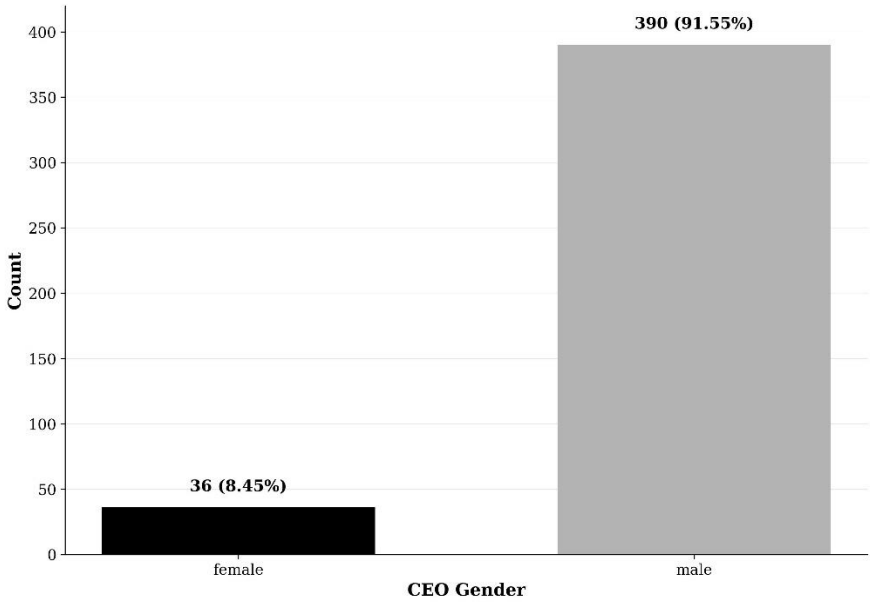
The linear regression model is represented by two econometric equations to determine the impact of different independent variables on the firm's total ESG risk scores, including social, environmental, and governance risk scores. Key factors of the study, including firm size, Tobin's Q, revenue growth, and female CEO, are measured in the first equation, which does not consider interaction effects. In contrast, the interaction effects are incorporated in the second equation, including Tobin's Q and female CEO. It allows exploration of the impact of female CEOs on ESG risk scores, depending on the firm's market valuations. Running both models shows how these variables affect ESG risk scores jointly and individually. The same equations are estimated separately for all three dimensions of ESG risk: social, governance, and environmental.

4. ANALYSIS, RESULTS AND DISCUSSION

4.1 Descriptive Analysis

Figure 1 demonstrates the distribution of female CEOs in the sample of selected firms from the S&P 500 index. There is a significant imbalance in gender roles among CEOs, as evidenced by the data: male CEOs are 91.55% in 390 firms, whereas female CEOs are in only 8.45% of the sample, making up only 36 firms. This evidence from the study shows that women in executive roles are significantly underrepresented, which is crucial to discussions of sustainability and corporate governance.

Figure 1: CEO Gender Distribution of Study Sample



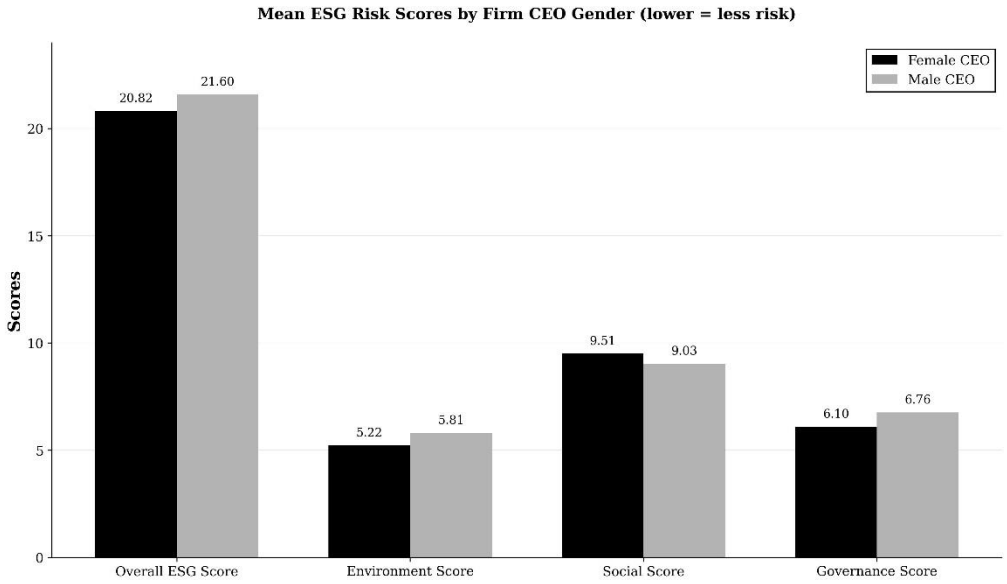
Source: Authors' own.

In exploring the relationship between corporate sustainability practices and female CEOs, the examination of social, governance, and environmental risk scores shows a distinct pattern that underpins the effect of gender on risk management and corporate governance. In Figure 2, data gathered from the S&P 500 index firms show that firms with female CEOs tend to have slightly lower ESG risk scores than firms with male CEOs, with scores of 20.82 and 21.6, respectively. The difference between these two results indicates that firms with female CEOs have more robust mechanisms for adopting sustainability principles and practices throughout the corporation.

Furthermore, the minimum variation is observed in environmental risk scores that measure the firm's management of ecological risk when a female CEO is present. The score is 5.22 for female CEOs compared with 5.81 for male CEOs. It shows a comparable level of environmental stewardship between male and female CEOs. It highlights the environmental governance in addressing different leadership styles. In contrast, the social aspect of ESG risk scores evaluates factors such as labour standards, diversity practices, community engagement, and other areas. Its scores suggest that female CEOs outperform male CEOs, with scores of 9.51 and 9.03, respectively. It shows that female CEOs have a greater sense of social responsibility, leading to more socially responsible initiatives by the firms. It reflects that female CEOs have a leadership style that prioritises social equity and stakeholders' engagement.

The governance risk scores measure the quality of shareholder rights and corporate management and favour females in executive positions within the firm, with a score of 6.1 compared with 6.76 for a male CEO. A lower governance risk score indicates better governance practices that improve internal controls, transparency, and ethical practices in the presence of a female CEO. The study's findings reveal the role of gender in firm leadership in the context of sustainability. It supports the suggestion that a female CEO may bring creative and unique priorities and perspectives. These insights are vital for understanding the overall implications of corporate governance, enhancing the firm's sustainability practices, and responding more effectively to increasing social and environmental challenges.

Figure 2: Average of ESG Risk Scores by Female CEOs



Source: Authors' own.

Descriptive analysis shows disparities across these domains when stratified by CEO gender. For the environmental risk scores, the firms managed by female CEOs show a slightly lower mean (5.219) compared with the firms led by male CEOs (5.808), although the difference is not statistically significant ($t = -0.636$, $p = 0.525$), showing that environmental management is irrespective of the CEO's gender. As far as social scores are concerned, firms led by female CEOs have scored marginally better on average (9.509) compared with firms led by male CEOs (9.032), but these differences are statistically insignificant ($t = 0.726$, $p = 0.468$), suggesting the same socially responsible policies and practices across the genders. More pronounced variations are evident in governance risk scores: female-led firms have lower scores (6.096) than male-led firms (6.762), with a p-

value near significance (0.079), suggesting that there may be more governance policies in place when leadership is female-oriented.

Table 1: Descriptive Analysis

Variables	Group	Mean	Median	Standard Deviation	Skewness	Kurtosis
Environment Risk Scores	Female CEO	5.219	2.670	5.481	1.614	3.113
	Male CEO	5.808	3.830	5.304	1.050	0.350
	Overall	5.758	3.765	5.315	1.092	0.530
	T-statistics	-0.636	P- value	0.525		
Social Risk Scores	Female CEO	9.509	8.440	4.326	0.739	0.438
	Male CEO	9.032	8.870	3.716	0.305	-0.125
	Overall	9.073	8.765	3.768	0.364	-0.023
	T-statistic:	0.726	P-value:	0.468		
Governance Risk Scores	Female CEO	6.096	5.710	1.706	1.643	3.854
	Male CEO	6.762	6.235	2.211	0.898	0.491
	Overall	6.706	6.200	2.179	0.949	0.620
	T-statistic:	-1.758	P-value:	0.079		
Revenue Growth	Female CEO	0.039	0.049	0.077	-0.382	0.455
	Male CEO	0.051	0.032	0.204	6.842	78.221
	Overall	0.050	0.035	0.196	7.022	83.560
	T-statistic:	-0.336	P-value:	0.737		
Tobin's Q	Female CEO	1.002	1.001	0.003	2.360	5.164
	Male CEO	1.003	1.001	0.022	18.888	366.524
	Overall	1.003	1.001	0.021	19.698	399.187
	T-statistic:	-0.264	P-value:	0.792		
Firm Size	Female CEO	14.530	13.984	2.332	0.476	0.013
	Male CEO	14.356	14.250	2.572	0.448	0.688
	Overall	14.371	14.237	2.551	0.446	0.648
	T-statistic:	0.389	P-value:	0.697		

Source: Authors' estimation.

Furthermore, revenue growth measures financial performance, and Tobin's Q measures market valuation. Similarly, firm size did not show significant gender-based differences, indicating overall consistency in growth in financial terms and market perceptions regardless of the CEO's gender. The results are characterised by insignificant statistical tests, indicating that there are some variations in ESG metrics among female CEOs, which did not translate into substantial disparities in governance outcomes and corporate financial performance.

4.2 Correlation Analysis

In this study, the relationship between Tobin's Q and various ESG components was examined to elucidate their interconnections. The findings suggest that the correlation between ESG risk scores and Tobin's Q is weakly negative (r = -0.05), indicating little disincentive to better ESG performance in firm valuation. The pattern was the same when analysing the ESG-specific proxies. The correlation between Tobin's Q and the

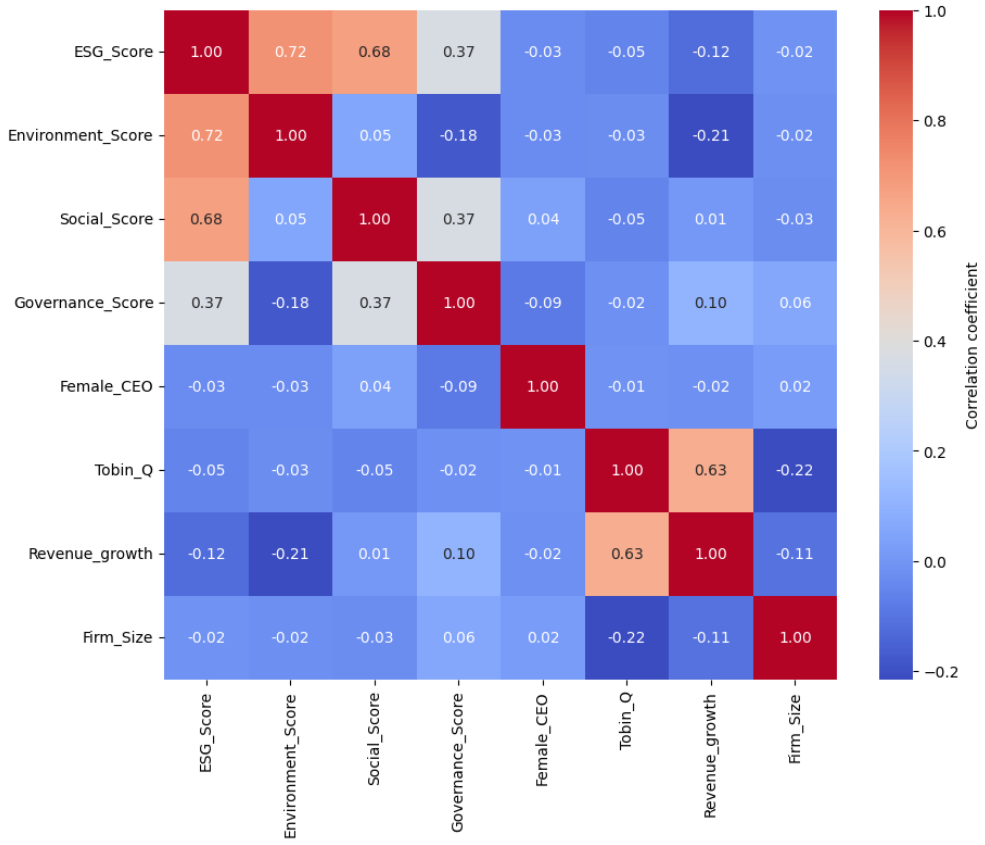
environment scores is negative (r = -0.03) and negative for social scores (r = -0.05), suggesting that stewardship between social and environmental rewards may not be fully recognised and rewarded by the market. Similarly, there is a slight negative correlation between governance scores and Tobin's Q (r = -0.09), suggesting a probable undervaluation relative to market assessment and governance quality.

Table 2: Correlation between Tobin's Q and ESG Risk Scores

Variables	**Tobin's Q**
Total ESG Risk Score	-0.05
Environmental Risk Score	-0.03
Social Risk Score	-0.05
Governance Risk Score	-0.09

Source: Authors' estimation.

Figure 3: Correlation Analysis



Source: Authors' own.

The findings of the study suggest that ESG factors, despite the crucial importance of sustainable firms' practices, do not translate into the higher valuation of the firm in the market, as measured by Tobin's Q. The non-alignment may be a result of the gap in market mechanisms, where long-run advantages of robust ESG practices and principles are overshadowed by short-run metrics. The findings suggest the need for deeper integration of ESG components into the firm's valuation to align investors' incentives with the business's sustainable outcomes (Lin 2026).

4.3 Regression Analysis

The regression results in Table 3 show how firm characteristics, market performance, and female CEO leadership relate to ESG risk scores. Tobin's Q has a positive and significant impact on all ESG risk score dimensions, underscoring the important role of market perceptions and financial health in achieving firms' sustainability goals. The findings of this study align with Yu et al. (2018). They highlighted that firms with higher performance often have better ESG practices, as their stakeholders have higher expectations and they have more resources to allocate to fulfilling sustainability goals (Alrashed et al., 2026). Firm size has mixed effects on firms' ESG metrics. Consistent with Galbreath (2018), governance scores are higher with larger firm size, suggesting that governance structures and practices have improved with firm size (Wong et al., 2022; Solimene et al., 2025).

Conversely, the environmental scores are negatively related to firm size, aligning with Yadav and Prashar's (2023) findings on the correlation between higher environmental standards and financial growth. It also supports Lee et al.'s (2024) thesis that a company's sustainable practices are threatened by its short-term financial achievements. However, there is a positive correlation between firm size and governance scores. This indicates that growing firms are relatively more motivated to improve their governance structures, consistent with Ali et al. (2022). Table 3 results support H1; Tobin's Q is significant for the total ESG risk score and for all three components. H2 receives only partial support, since firm size matters only for governance risk. H3 is supported for the total and environmental risk scores but not for the social and governance dimensions. H4 holds only for the environmental dimension, where the interaction between female CEO and Tobin's Q is statistically significant; the interaction terms for the other dimensions are insignificant.

Table 3: Regression Analysis

Variables	**ESG Risk Score**		**Environmental Risk Score**		**Governance Risk Score**		**Social Risk Score**	
Tobin's Q	21.15***	20.38***	7.805***	7.836***	5.638***	5.365***	9.176***	8.819***
	(2.868)	(2.92)	(1.419)	(1.458)	(0.600)	(0.62)	(1.036)	(1.07)
Firm Size	-0.053	-0.0120	-0.10	-0.11	0.0735*	0.0925**	-0.02	0.00
	(0.133)	(0.1377)	(0.10)	(0.10)	(0.0408)	(0.0422)	(0.07)	(0.07)
Female CEO	-0.8922	-534.5	-0.55	-938.80***	-0.6878*	79.90	0.36	346.14
	(1.2376)	(475.36)	(0.90)	(341.65)	(0.3796)	(145.32)	(0.66)	(250.80)
Revenue Growth	-6.031***	-5.8***	-6.468***	-6.301***	0.87	0.90	-0.54	-0.54
	(1.8131)	(1.817)	(1.308)	(1.303)	(0.55)	(0.55)	(0.96)	(0.96)
Female CEO × Tobin's Q	-	536.72	-	927.53***	-	-75.67	-	-336.73
		(470.60)		(338.22)		(143.87)		(248.29)
R^2	0.9037	0.9043	0.5709	0.5786	0.9064	0.9072	0.8568	0.8581
F-Stat	777.25 ***	556.19 ***	110.15***	80.823***	802.28***	575.42***	495.46***	355.96***

*Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are reported in parentheses.*

Source: Authors' estimation.

Moreover, the moderating effect of the female CEO on the relationship between firm performance and ESG risk scores varies across ESG dimensions. The moderating role of the female CEO shows a positive effect on firm performance and environmental risk scores. These findings show that firm performance in the presence of a female CEO has a statistically significant and pronounced correlation with environmental risk management. The positive coefficient shows that as the firm's financial performance increases, the presence of a female CEO improves the efficiency and effectiveness of environmental risk mitigation strategies. This supports previous research suggesting that female leadership often results in stronger accountability and a more proactive approach to environmental issues (Irawati and Marlina 2022; Gull et al., 2026; Chen et al., 2025).

In contrast, the corresponding interaction terms are insignificant for social and governance risk scores. There is a negative but statistically insignificant effect on governance risk, suggesting that a firm's CEO's gender does not significantly affect the relationship between firm financial performance and governance risk. Furthermore, this may indicate that governance risk is more influenced by regulatory, systemic, and policy-oriented factors than by individual leadership qualities (Shobhwani and Lodha 2023; Wan Ismail et al., 2026). Likewise, the interaction term for social risk is also insignificant and negative, suggesting that factors such as customer satisfaction, community engagement, and labour practices may be less affected by changes in financial performance when a female CEO serves as a moderator. Social and governance risk scores rely more on long-term corporate culture and strategic planning than on leadership influence (Sitorus et al., 2023; Pernamasari 2025).

The discrepancy witnessed across the ESG dimensions emphasises the difficulty of determining how leadership qualities intersect with firm performance to affect diverse characteristics of sustainability. There is a significant positive relationship among female CEOs, financial performance, and environmental risk management, reaffirming that gender-diverse leadership can be effective in addressing the challenges of environmental sustainability (Sujatmiko et al., 2023; Mei et al., 2025). Conversely, there is an insignificant relationship between social and governance risks and board gender diversity and CEO gender, which drive firm performance. There is a need for deeper insight into the cultural and structural dimensions within a firm that may buffer the effect of leadership gender on these areas of ESG performance (Qin 2023; Saini et al., 2025).

Therefore, the study suggests evaluating firm size, board composition, and firm performance, particularly the relationship between women's inclusion and corporate sustainability outcomes. These findings not only validate existing studies but also show the importance of a differentiated and contextual approach to improving corporate sustainability, underscoring the involvement of diverse perspectives in sustainability strategies within the scope of benefits of diversity in financial performance and size (Liu et al., 2023; Najaf et al., 2025).

5. CONCLUSION

This study evaluates in depth the moderating role of the female CEO in the relationship between sustainability, size, and firm performance, considered through the lenses of ESG risk scores. A strong regression model is used to validate that the female CEO significantly improves the relationship between ESG risk score and firm performance. The study results show that gender diversity has a positive effect on corporate boards, and that the role of female CEOs and directors in ensuring the firm's sustainability goals through firm performance is crucial.

Firm size and firm performance have positive moderating effects when combined with a female CEO on ESG risk scores, indicating that gender-diverse boards are more likely to include sustainability in their corporate strategy. A moderating effect of the female CEO is essential to improve the overall governance framework and to make sustainability a part of strategic decision-making. The research confirms that when a company is well managed and efficient, and discloses environmental, social, and governance (ESG) risks, its market value goes up, which is an incentive and an asset for the company's financial performance. This research discusses how crucial it is for companies to implement ESG practices in their governance and offers likely financial consequences of ESG risk management.

The findings come with limitations. The dataset covers a single year, 2023–24, so the estimates capture cross-sectional associations rather than changes over time, and causal claims cannot be made. Only 36 of the 426 sample firms have a female CEO; this small subsample reduces the precision of the moderation estimates. The sample is restricted to large, publicly listed US firms, so the results may not generalise to smaller companies or other markets, and the ESG risk scores are from a single rating provider (Stewart 2026). Future research could follow firms over several years, test other markets, address the endogeneity of CEO appointments through instrumental variables or matching, and examine board-level diversity alongside the CEO position.

6. POLICY RECOMMENDATIONS

The study's findings recommend increasing women's representation in influential board positions. Firms can leverage the unique leadership qualities and perspectives of women by ensuring that they hold significant decision-making roles that drive sustainable practices in the firm. In addition, a dedicated sustainability committee with diverse board members could lead to more integrated sustainability goals within the governance structure. Regulatory bodies and governments may adopt policies that promote gender diversity on the firm's board and help incorporate sustainability objectives into the firm's corporate governance framework (Fernández-Méndez and Pathan 2025). Incorporating such practices and policies would not only strategically align business operations with sustainability goals but also foster an inclusive, sustainable business environment. Furthermore, this research opens avenues for future researchers to explore the impact of sustainability on board diversity beyond gender, such as professional and cultural diversity. In addition, future

researchers may explore the long-term effects of board diversity on firm resilience in changing economic climates, which would provide deeper insights into its impact on corporate growth and a sustainable corporate environment.

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