

The Moderating Effect of Climate Change Risk Exposure on the ESG Performance–Financial Sustainability Nexus: Evidence from S&P500 Companies

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Research Article

Keywords: Climate change risk, ESG performance, Financial sustainability, S&P500

Posted Date: June 19th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9767628/v1>

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Additional Declarations: No competing interests reported.

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Abstract:

This study aims to examine the impact of environmental, social, and governance (ESG) performance on the financial sustainability (FS) of non-financial S&P500 companies while controlling for the moderating effect of climate change risk exposure (CCRE). Based on a comprehensive dataset of 2916 firm-year observations spanning 2015 to 2023, the findings indicate that ESG performance improves FS and that CCRE significantly strengthens this effect. These findings are insensitive to rigorous robustness checks, including alternative estimation techniques and measures of variables. In line with assumptions of stakeholder theory, this study highlights the importance of integrating climate change risk management mechanisms into firms' ESG strategies to optimize FS. It provides valuable theoretical and managerial insights, illustrating how firms can strategically mitigate CCRE to boost the credibility of their ESG performance and optimize their long-term financial health.

Keywords: Climate change risk, ESG performance, Financial sustainability, S&P500.

JEL code: G32; M14; Q56

1. Introduction

The accelerating realities of climate change and the increasingly severe manifestations of weather extremes worldwide underscore the critical imperative of sustainability. Recent decades have witnessed unprecedented climatic disturbances, intensified heat-waves, recurrent flooding, protracted droughts, and widespread wildfires, largely driven by the rapid accumulation of greenhouse gases in the atmosphere (IPCC, 2021). These developments underscore the pressing need to establish robust and forward-looking sustainable development pathways to safeguard environmental integrity, promote social well-being, and foster long-term economic resilience. In response, governments and corporations worldwide have intensified efforts to incorporate sustainability principles into policy frameworks and strategic agendas. For example, the United States has strengthened climate-related disclosure requirements through the Securities and Exchange Commission, whereas firms globally, including those within the S&P500, face heightened expectations from investors and regulatory bodies to adopt comprehensive ESG practices that mitigate climate risks and safeguard financial stability (Friede *et al.*, 2015; Krueger *et al.*, 2020).

Numerous past studies have focused on environmental quality, carbon emissions, and pollution control (Ahmed *et al.*, 2021). However, sustainability encompasses more than just environmental issues. In essence, the achievement of the Sustainable Development Goals (SDGs) represents advances across all interlinked dimensions of environmental care, social development, and quality of institutions, each of which, reflects a significant pillar within an integrated ESG framework according to the United Nations. Recent studies highlight the importance to introducing social and governance perspectives to capture long-term corporate sustainability (Khan *et al.*, 2022; Liu and Zhang, 2022). While such attention is given to all the pillars of sustainability, empirical literature still lacks any combined analysis of how ESG performance impacts FS. Compounding this limitation is the lack of attention paid to climate risk exposure, a critical determinant of corporate vulnerability. Climate risk's traits, such as physical risks and transition risks, may result in fundamental changes in investment behavior, operational performance, decisions on capital allocation, and ultimately the long-term financial outcomes of a firm (Bolton and Kacperczyk, 2021). Against this backdrop, the role of climate risk in shaping the financial returns of ESG engagement remains underexplored. Stakeholder theory (Freeman, 2010) provides a strong explanation for why firms undertake socially responsible initiatives, asserting that significant pressure from stakeholders related to climate threats compels firms to commit to ESG engagements. Hence, companies experiencing high levels of climate risk could theoretically use ESG activities as strategic assets that fuel resilience, dampen uncertainty, and convey credibility to stakeholders. In turn, greater climate risk may deplete firms' capability to capitalize on ESG commitments due to resource preemption, operational disruptions, or competition from other risk sources. These contesting dynamics suggest that climate risk exposure represents an important but understudied moderator in the ESG–FS nexus.

Understanding this relationship is particularly salient for companies in the S&P500, which represent global market leaders operating across diverse industries with varying levels of climate exposure. While prior studies have researched ESG–financial performance relationships and explored climate risk impacts independently (Friede *et al.*, 2015; Bolton and Kacperczyk, 2021), few studies have integrated both domains to understand how climate vulnerability conditions the financial relevance of sustainability strategies (Krueger *et al.*, 2020; Ozkan *et al.*, 2023).

This study has several theoretical contributions. First, it provides the first integrated empirical assessment of how climate risk exposure moderates the ESG performance–FS nexus in S&P500 firms. Whereas prior studies have considered either ESG performance or climate risk separately, the combined effect is thus far unexplored, representing an important conceptual and empirical gap in sustainability research. Second, this research employs a multidimensional ESG framework, which goes beyond traditional environmental-focused studies to offer an integrated view to the ways in

which ESG pillars support together financial resilience in the long term. This calls for a more comprehensive approach to sustainability research. Third, the focus on S&P500 firms provides meaningful insights for global policymakers, investors, and corporate managers by showing how climate-related dangers interact with sustainability strategies at the core of the global capital market. These results have practical implications for risk management, ESG strategies, and corporate governance reforms. Finally, this study contributes to the greater discussion of sustainability by indicating the conditions under which ESG engagement improves or fails to improve FS and thus strategically informs the design of climate-aligned corporate practices.

The remainder of this paper is organized as follows. Section 2 addresses the relevant literature background and develops hypotheses. Section 3 depicts the methodology used. Section 4 summarizes and discusses obtained results. Section 5 presents the robustness checks. Section 6 concludes.

2. Literature review and hypothesis development

2.1. ESG performance as a driver of FS

Modern corporate finance scholarship has paid attention to how does ESG performance matter for FS. It has been increasingly observed that FS, a firm's long-term ability to maintain cash flow, manage risks, and have continuous access to capital are related to sustainability practices (Friede *et al.*, 2015). With increased pressure from global markets for responsible behavior, understanding how ESG performance contributes to financial resilience has garnered academic and regulatory importance (Dos Reis Cardillo and Basso, 2025; Shan *et al.*, 2024). The theoretical underpinning that explains this relationship is mainly drawn from several theories that support the assumption of the positive ESG performance-FS correlation. The resource-based view (RBV) theory argues that ESG capabilities are the valuable, rare, and inimitable resources responsible for sound governance structures, environmental innovations, and human-capital practices. In this vein, ESG performance can enhance operational efficiency and reduce risks, thus offering financial stability in the long run through its sustainable competitive advantage.

Additionally, according to institutional theory, firms adopt ESG practices because of regulatory, normative, and mimetic environmental pressures. In turn, adoption will lead to increased institutional legitimacy, reduced legal and compliance risks, facilitated access to financial and non-financial resources, and consolidated financial resilience (CMA, 2023). Ultimately, signaling theory supposes that ESG performance serves as a relevant signal to stakeholders regarding managerial competence, long-term orientation and attitude toward risk. Wilberg *et al.*, (2025) and Shan (2024) underscore that these three capabilities lower the cost of capital and enhance FS.

Recent empirical evidence largely corroborates these theories and support the monotone nature of the ESG performance–FS nexus. Large–scale multi–country studies, together with updated meta–analyses, report that ESG strength is associated with higher firm value, lower stock price volatility, and lower financing costs (Dos Reis Cardillo and Basso, 2025). Environmental and governance dimensions have been strongly linked to higher credit ratings, lower borrowing costs, and better access to long–term capital. These improvements are often attributed to stronger risk management practices, reduced regulatory uncertainty, and growing investor preference for sustainability–oriented firms (Shan, 2024).

While theoretical frameworks outline the mechanisms through which ESG performance can enhance long–term financial resilience, other studies emphasize that the ESG–FS connection is bound by industry characteristics, firm size, regulatory context, and the quality of sustainability reporting. According to Khan *et al.*, (2022), businesses operating in highly visible industries or industries sensitive to the environment tend to gain more from their ESG investments. However, their smaller counterparts may face short–run cost burdens that dampen any financial impact (Kim and Koo, 2023). In addition, variations in ESG rating systems and disclosure quality contribute to mixed results, raising the need for more harmonized ESG metrics (Gibson *et al.*, 2021). Another critical issue is endogeneity. Financially successful firms might be in a better position to invest in ESG initiatives, hence the problem of reverse causality. To surpass this, recent research applies the generalized method of moments (GMM) (Zhang, 2025), difference–in–differences, and instrumental variable approaches (Basali, 2025). The newer methods yield much more confident proof that ESG performance can have a causal impact on financial outcomes by reducing the costs of capital, enhancing resilience, and reducing downside risk. Accordingly, we hypothesize the following:

H1: ESG performance significantly enhances FS.

2.2. The moderating effect of CCRE exposure on the ESG performance–FS nexus

CCRE includes both physical and transition risks. The manner emanates from direct climatic changes that can damage infrastructure, disrupt operations, and enhance insurance and recovery costs. The latter is linked to societal efforts to address climate change, such as stricter regulations, carbon pricing, technological shifts, and shifting consumer preferences (IPCC, 2021; Bolton and Kacperczyk, 2021). Both forms of risk shift the economic stakes of environmental and governance action. When firms face greater climate exposure, investments in environmental capabilities,

resilience, and governance are more likely to protect cash flows, avert losses, and preserve asset values. Therefore, climate risk can strengthen the payoff from ESG activities by increasing their risk mitigation value (Almaghrabi, 2024). Lu *et al.*, (2025) used firm-level climate exposure measures and found that under higher climate exposure risk, firms often have greater improvements in ESG practices which reduces risk and enhances financial benefits.

The literature demonstrates that CCRE can boost the effect ESG on FS through three pillars. First, for firms with high levels of physical or policy-related climate risk, the adoption of environmental and governance measures directly reduces the expected loss and compliance cost burdens, thus enhancing organizational resilience and fostering long-term FS (Ramos-García *et al.*, 2023). Second, non-misleading climate-related risk reporting improves the market perceptions of ESG practices and reduce information asymmetry between management and stakeholders. Companies adopting ESG practices in concert with high-quality reporting of climate risks typically obtain greater market and financial rewards for their investments in sustainability initiatives than do others. Conversely, inadequate or inconsistent disclosure lowers the financial benefits of ESG performance (Bagh *et al.*, 2024). Third, Climate exposure often enhances green innovation and capital reallocation toward low-carbon activities, where these investments are possible and well governed they increase productivity and long-term returns, thus amplifying ESG's positive financial effects (Bala *et al.*, 2025).

However, some studies have concluded that the CCRE doesn't matter in a uniformly positive manner. In cases in which climate shocks are extreme or the cost of adaptation is prohibitively high, ESG investments may be insufficient to prevent asset impairment or cash-flow collapse, weakening or even reversing financial benefits. Several empirical studies have reported negative or muted ESG financial effects in highly exposed firms that lack financial flexibility. On the one hand, firms characterized by weak corporate governance or poor managerial capacity fail to transform ESG spending into effective risk reduction; in such cases, climate risk does not strengthen and may even attenuate the ESG-financial link (Niu *et al.*, 2024). On the other hand, Zhang *et al.*, (2024) highlighted that the moderating role of climate risk is stronger within climate-sensitive industries (eg., energy, utilities and agriculture) while being less consistent in sectors with lower direct physical exposure. Studies immersed on emerging markets demonstrate context-specific patterns and negative associations in some samples, which underline regional heterogeneity (Al-Kubaisi and Abu Khalaf, 2025).

Despite the diversity of empirical findings, most existing literature supports the evidence that the ESG performance–FS nexus is stronger under higher levels of CCRE, underlying the enhancing moderating role of CCRE. Thus, we propose the following hypothesis:

H2: CCRE positively moderates the ESG performance–FS relationship.

3. Research methodology

3.1. Sample and data

The initial sample is based on non-financial firms traded on the S&P500 Index from 2015 to 2023. S&P500 firms were selected because they experience pressures from different stakeholders to prove their accountability towards socially responsible behaviors such as green investments, carbon emissions and ESG practices. Furthermore, the analysis of S&P500 companies' ESG performance helps investors to better understand environmental traits and opportunities and allows managers to behave more socially responsible. The environmental performance of S&P500 companies has implications for promoting sustainability, mitigating risks, and making informed investments and policy decisions (Liu, 2024).

The choice of the sample period is guided by two important factors. First, 2015 was the year of the Paris Climate Accord's embracement and the subsequent year where the Global Reporting Initiative (GRI, 2014) launched the G4 sustainability reporting guidelines expected to improve the ESG disclosure's quality and process. In fact, after the adoption of the Paris Climate Accord, governments in G7 countries have introduced climate disclosure regulations (Environmental), promoted socially inclusive transitions to net zero (Social) and enhanced firms' climate accountability by integrating climate risk in board oversight and executive compensation (Governance). Moreover, the GRI signifies the onset of consistent and reliable reporting of ESG factors by U.S firms, as regulatory frameworks and voluntary disclosures related to sustainability gained significant momentum during this period. Second, the decision to conclude the study in 2023 was made to mitigate possible bias arising from the COVID–19 epidemic outbreak. The dataset ended in 2023 when this year marked the end of the COVID–19 outbreak period.

This study applied several standard data–screening procedures to refine the initial sample. Firms in the financial sector were excluded because of financial irregularities. Observations with significant missing data were omitted and continuous variables were winsorized at the 1st and 99th percentiles to alleviate extreme outliers' influences. The final sample consists of an unbalanced panel of 2916 firm–year observations representing 324 unique companies. The data were gathered from multiple sources. Firm-level ESG performance, financial and corporate governance metrics

were obtained from the Bloomberg Data Service. Firm-level CCRE was assessed using the index developed by Sautner *et al.*, (2023a).

3.2. Models

To emphasize the FS–ESG performance nexus, we developed the following model:

$$FS_{i,t} = \beta_1 + \beta_2 ESG_{i,t} + \sum \beta_k X_{k,it} + \mu_i + \mu_t + \varepsilon_{it} \quad (1)$$

Where, $FS_{i,t}$ and $ESG_{i,t}$ are proxies for FS and ESG performance, respectively. X denotes a standard set of firm-specific factors identified in the literature as determinants of FS, including size, working capital, and return on equity. Furthermore, we control for boardroom-related attributes such as size, independence, and gender diversity, all of which may impact corporate FS. Incorporating these variables provides a comprehensive understanding of the canals through which ESG performance involves corporate FS.

Moreover, to examine how FS impacts each ESG pillar—environmental (ENV), social (SOC) and governance (GOV), we run the following models:

$$FS_{i,t} = \beta_1 + \beta_2 ENV_{i,t} + \sum \beta_k X_{k,it} + \mu_i + \mu_t + \varepsilon_{it} \quad (2)$$

$$FS_{i,t} = \beta_1 + \beta_2 SOS_{i,t} + \sum \beta_k X_{k,it} + \mu_i + \mu_t + \varepsilon_{it} \quad (3)$$

$$FS_{i,t} = \beta_1 + \beta_2 GOV_{i,t} + \sum \beta_k X_{k,it} + \mu_i + \mu_t + \varepsilon_{it} \quad (4)$$

To identify how CCRE affects the connection between ESG performance and FS, the following model is developed:

$$FS_{i,t} = \beta_1 + \beta_2 ESG_{i,t} + \beta_3 CCRE_{i,t} + \beta_4 ESG_{i,t} * CCRE_{i,t} + \sum \beta_k X_{k,it} + \mu_i + \mu_t + \varepsilon_{it} \quad (5)$$

where β_2 (β_4) determines the validity of Hypothesis 1. To address endogeneity concerns, ordinary least squares (OLS) and two-way fixed-effects (FE) regressions adjusted for individual and time-specific effects were performed. Variables' descriptions are detailed in Table 1.

Table 1. Variable descriptions

Variable	Acronym	Description	Source
ESG score	ESG	ESG disclosure score	Bloomberg Data Service
Environment score	ENV	ENV disclosure score	
Social score	SOC	SOC disclosure score	
Governance score	GOV	GOV disclosure score	
Financial sustainability	FS	Return on equity*retention ratio	Bloomberg Data Service
Climate change risk exposure	CCRE	Firm-level climate change risk exposure	https://doi.org/10.17605/OSF.IO/FD6JQ

		from Sautner <i>et al.</i> , (2023a)	
Firm size	FSIZ	Natural logarithm of total assets	Bloomberg Data Service
Working capital	WCP	Current Assets – Current Liabilities	
Return on equity	ROE	Net Income / Shareholders' Equity	
Board size	BRDSZ	Total number of board members	
Board independence	BRDIND	Percentage of independent board members	
Board gender diversity	BRDG	Percentage of female board members	

4. Empirical results

4.1. Descriptive statistics and correlation analysis

Descriptive statistics are summarized in Table 2. The mean FS value is 0.1525 reflecting modest profitability with a standard deviation of 0.567 indicating variation across firms. The aggregate ESG performance has a mean of 3.8616 and a standard deviation of 0.2735, suggesting that it is generally moderate, but some firms excel more than others do. The CCRE index has an average value of 0.0014. The median being lower than the mean suggests that most firms incur climate change treatments, with only a minority engaging in substantial climate risk mitigation, resulting in a slightly right-skewed distribution. Control variables provide critical insights into financial and corporate governance features of S&P500 firms, offering a foundation for interpreting their FS and ESG performance. Notably, 60.66% (21.4%) of board seats are occupied by independent (female) directors, suggesting a modest adoption of good corporate governance practices. However, firms tend to show stronger ESG performance and better long-term financial health, likely due to the reputational benefits of boardroom independence and gender diversity. Selected firms also demonstrate a mean return on equity of 0.7724 with values ranging from –0.003 to 0.1526 and a relatively small mean of working capital. Overall, the distributions are consistent with prior literature and multicollinearity doesn't matter as variance inflation factors (VIFs) for all variables are below the conventional threshold of 5.

Table 2. Descriptive statistics

Variable	N	Mean	S.D	Min	Max	P5	P25	P50	P75	P95	Skewness	Kurtosis	VIF	1/VIF
FST	2916	0.1525	0.5670	0.0010	12.0248	0.0010	0.0100	0.0327	0.1094	0.6351	2.6292	2.9410	1.19	0.7052
ESG	2916	3.8616	0.2735	2.7334	4.4691	3.4551	3.6340	3.8962	4.0840	4.2698	−2.2029	2.2033	1.08	0.9256
ENV	2916	2.8190	1.4663	0.0000	4.5358	0.0000	2.3852	3.4530	3.8913	4.2543	−1.0225	1.5030	1.01	0.3345
SOS	2916	3.1494	0.6471	0.1028	4.3835	2.2203	2.6769	3.2416	3.6306	3.9703	−1.2888	1.8100	1.99	0.3492
GOV	2916	4.4861	0.0701	3.7852	4.6151	4.4311	4.4541	4.4827	4.5438	4.5901	−2.7714	2.6869	1.53	0.6509
CCRE	2916	0.0014	0.0039	0.0000	0.0509	0.0000	0.0001	0.0003	0.0009	0.0066	2.0363	2.8227	1.11	0.8924
BRDSZ	2916	11.4631	0.2204	7.6931	14.5951	6.0794	8.3979	10.4849	10.5649	10.7726	−1.3885	1.6256	1.20	0.8314
BRDIND	2916	0.6066	0.0548	0.2877	0.6931	0.4925	0.5878	0.6190	0.6466	0.6568	−1.7590	1.8427	1.10	0.9065
BRDG	2916	0.2140	0.0894	0.0000	0.6931	0.0870	0.1542	0.2231	0.2683	0.3483	0.3984	0.1445	1.11	0.8999
FSIZ	2916	3.2064	0.0680	2.4057	3.3943	3.1098	3.1723	3.2076	3.2447	3.3018	−2.4529	2.2018	1.35	0.7428
WCP	2916	0.2492	0.1457	0	2.7025	0	0.5346	0.7949	1.0485	1.5666	0.1142	0.1483	1.04	0.9614
ROE	2916	0.7724	0.4743	−2. 5779	12.3106	−0.0030	0.0163	0.0582	0.3433	0.1526	0.7252	0.0139	1.06	0.9452
Mean VIF													1.50	0.7644

Note: This table summarizes key descriptive statistics. N: number of observations. SD: standard deviation. All variables are defined in the Appendix.

Source: Authors own work.

Table 3 displays Pearson correlations. The results suggest a strong and meaningful significant connection between ESG performance and FS. CCRE is negatively correlated with ESG (-0.0557) and FST (-0.0041), both significant at the 5% level, indicating that firms exposed to higher climate change risk achieve worse ESG performance and FS. The correlations between board features and ESG performance are highly robust, suggesting meaningful improvement in firms' ability to perform better. Furthermore, FS and the primary control factors showed a significant association. This finding suggests that the control variables chosen for this study were suitable.

4.2. Effects of FS on aggregate ESG performance and pillars

The left side of Table 4 summarizes the results of the OLS regression analysis showing a highly significant positive relationship between FS and aggregate ESG performance. The right side displays the time and industry-fixed effects-controlled results and displays a similar positive effect (coefficient = 0.4417 , t -value = 10.47). These findings suggest that better FS increases socially responsible decision-making for firms, leading them to adopt more investments in ESG initiatives, ultimately raising ESG performance. These results prove those reported by Wilberg *et al.* (2025) and Zhang (2025).

Control variables are incorporated across both specifications. Among firms' economic characteristics and board attributes, ROE, board size, and board gender diversity have a highly positive effect on FS. However, firm size has a negative effect. A possible explication of these facts is that firms with higher ROE and better corporate governance features may pay more attention to long-term ESG responsibilities, resulting in better FS. With regard to control variables, results align with prior research (Basali, 2025; Niu *et al.*, 2024; Ozkan *et al.*, 2023) and support H1.

Table 3. Pearson correlation matrix

	FST	ESG	ENV	SOS	GOV	CCRE	BRDSZ	BRDIND	BRDG	FSZ	WCP	ROE
FST	1											
ESG	0.0574***	1										
ENV	0.0666***	0.9004***	1									
SOS	0.0618***	0.8823***	0.7733***	1								
GOV	0.0269***	0.6573***	0.4788***	0.5076***	1							
CCRE	-0.0041**	-0.0557***	-0.0860***	-0.0373***	-0.0294	1						
BRDSZ	-0.1241**	0.0657***	0.0547***	0.0701***	0.0571***	0.0141**	1					
BRDIND	-0.0706**	0.1296***	0.0856***	0.1302***	0.0962***	0.0423***	0.0347***	1				
BRDG	0.1080***	0.2288***	0.2067***	0.2376***	0.1443***	0.0199**	0.0422***	0.2402***	1			
FSIZ	-0.5245**	0.1419***	0.1464***	0.1368***	0.1007***	0.0000**	0.4193***	0.1979***	0.1053***	1		
WCP	-0.0365*	-0.1011**	-0.1226**	-0.1210**	-0.0050**	-0.0502*	-0.1090**	-0.0777***	-0.0861***	-0.1666***	1	
ROE	0.3009***	-0.0090**	-0.0160**	0.0072**	-0.0020**	-0.0522*	0.0686**	0.0311***	0.0090***	0.2072***	-0.0692***	1

Notes: This table summarizes Pearson correlations. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table1.

Source: Authors own work.

Table 4. Effect of FS on aggregate ESG performance

Variable	OLS	FE
ESG	0.2527*** (7.00)	0.4417*** (10.47)
BRDSZ	0.2087*** (4.13)	0.2317*** (5.07)
BRDIND	−0.1174 (−0.64)	0.2089 (1.22)
BRDG	1.0769*** (9.35)	1.0356*** (11.27)
FSIZ	−3.4224*** (−35.23)	−7.8603*** (−81.16)
WCP	−0.0304 (−0.46)	−0.2749 (−3.20)
ROE	1.0799*** (7.21)	0.0350*** (0.27)
Constant	19.2130*** (35.37)	45.2931*** (78.69)
Number of obs	2,916	2,916
Adjusted R²	0.3729	0.3017
F–statistic	217.44***	957.39***

Notes: This table displays empirical OLS and FE baseline results from model (1). 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table 1. T–statistics are in parentheses.

Source: Authors own work.

Table 5 outlines the results of the year and industry–fixed effects regression analyses including Environment, Social and Governance scores and control variables. As shown, all ESG performance's pillars have positive and highly statistically significant effects on FS, with coefficients of 0.06 in Model 1, 0.15 in Model 2 and 0.625 in Model 3, respectively. Control variables behave as expected. Board size and boardroom gender diversity have positive and significant effects on FS. In addition, ROE was found to be positively related to FS in all models. By contrast, firm size (working capital) has a significant (insignificant) negative impact effect. Overall, fixed–effects regressions on the sub–components of ESG performance provide robust evidence that ESG performance actively promotes FS, providing further strong support for Hypothesis 1.

From a theoretical view, these findings corroborate the dual channels proposed by the signaling and stakeholder theories. On the one hand, higher ESG performance serves as a credible signal of strategic foresight and managerial ESG orientation, attracting sophisticated investors seeking long-term value. On the other hand, the corporate structured orientation about transition toward environment, social and governance roadmaps significantly reduces investors' initial search costs, enabling a more efficient allocation of sustainable financial resources. This dual mechanism explains why ESG performance functions both as an "attention-getter" and an "added value guide" in capital markets. Moreover, aligning with stakeholder theory, the findings underscore the importance of integrating firm-level economic and board features into firms' ESG strategies to optimize corporate FS.

The dual positive interaction between the aggregate ESG performance and pillars and corporate FS are consistent with Hossain *et al.*'s (2025) findings that ESG performance generally enhances FS and corroborates Gangi *et al.*'s (2019) assumptions that incorporating ESG principles into business operations allows firms to better manage environmental and social risks, ultimately contributing to financial resilience. As companies navigate increasingly complex risks, ESG performance aligns corporate objectives with stakeholder expectations, thereby reinforcing their long-term viability and ensuring FS. Furthermore, these results are supported by Wong *et al.*, (2025) revealing a significant direct and positive effect of employees' perception of their organization's social and governance practices on corporate FS throughout their citizenship behavior. The study provides evidence that ESG practices can be pertinent to firms' long-term FS.

Table 5. Effect of FS on sub-components of ESG performance

Variables	(1) ENV FE	(2) SOS FE	(3) GOV FE
ENV	0.0607*** (9.57)		
SOS		0.1509*** (9.15)	
GOV			0.6246*** (5.04)
BRDSZ	0.2444*** (5.34)	0.2492*** (5.44)	0.2646*** (5.70)
BRDIND	0.2191 (1.28)	0.1760 (1.02)	0.2290 (1.32)
BRDG	1.1479*** (12.86)	1.1196*** (12.33)	1.3142*** (14.89)
FSIZ	-4.7048*** (-8.02)	-4.7169*** (-8.77)	-4.5961*** (-7.10)
WCP	-0.2825 (-1.27)	-0.2666 (-1.08)	-0.2608 (-0.98)
ROE	0.0117*** (3.09)	0.0059*** (3.05)	0.0370*** (3.28)
Constant	46.2691*** (79.24)	46.0161*** (79.08)	43.1900*** (58.53)
Observations	2,916	2,916	2,916
Number of groups	323	323	323
R-squared (Within)	0.7493	0.7485	0.7419
R-squared (Between)	0.2994	0.2982	0.2905

Notes: This table displays empirical OLS and FE baseline results for ESG pillars. Industry and year fixed effects are included. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table 1. T-statistics are in parentheses.

Source: Authors own work.

4.3. The moderating effect of CCRE

Table 6 reports industry and year fixed effects' estimates from Equation (5), including CCRE as a moderating variable and controlling for the firm's financial and corporate governance features. It shows that ESG performance significantly boosts FS (p-value <0.05). Supporting stakeholder theory, this result confirms that companies invest in ESG indicators to preserve their FS. It corroborates recent results by Hossain *et al.* (2025) based on a comprehensive Chinese dataset spanning from 2009 to 2021. In addition, this finding validates stakeholder theory and goes in line with Faizulayev (2026), confirming that ESG factors play a significant role in driving the FS within the banking sector. Moreover, it aligns with our baseline results and supports Hypothesis H1. Furthermore, CCRE significantly mitigates FS (p-value <0.05), indicating that higher CCRE harms the corporate FS of the sampled firms. Alike findings were obtained by Naseer *et al.*, (2024), supporting evidence that CCRE might injure corporate FS due to costs underlying environmental traits. That is, firms incurring severe climate change risks tend to have lower FS because of CCRE-related financial losses. The coefficient on the interaction term (ESG*CCRE), highlighting the moderating effect of the CCRE, is significantly negative, showing that under higher CCRE, the positive effect of ESG performance on FS is limited. This finding receives support from Javed and Bhutta (2025), who empirically found that transition and physical climate risks are damaging drivers of corporate FS. Indeed, our findings confirm those of Karaman *et al.* (2021), revealing that the environmental degradation assessed by the ecological footprint alleviates the ESG performance-FS linkage within the energy industry. Furthermore, Naseer *et al.*, (2024) have reached similar findings, indicating that firm value has a positive effect on ESG performance and that CCRE moderates this effect by enhancing risk and reducing value.

As expected, FS and ROE ratios are positively associated (p-value <0.01), strengthening the notion that better market performance provides FS to corporations. Further, firms with higher boardroom gender diversity and board size also demonstrate better FS, aligning with premises that show that better corporate governance features often promote FS.

Table 6. Moderating effect of CCRE

Variables	FE Model
ESG	0.4787*** (7.72)
CCRE	-1.6709** (-2.40)
ESG* CCRE	-1.9104** (-2.16)
BRDSZ	0.0089** (2.51)
BRDIND	0.0809 (0.58)
BRDG	0.9991*** (9.34)
FSIZ	-0.6492*** (-46.51)
WCP	-0.0099 (-0.21)
ROE	0.1099*** (6.08)
Constant	13.3017*** (36.52)
Observations	2,916
Number of groups	323
R-squared (Within)	0.5343
R-squared (Between)	0.1452
R-squared (Overall)	0.1853
F-statistic	280.92***

Notes: This table displays empirical results of the moderating effect of CCRE on the ESG performance-FS nexus. Industry and year fixed effects are included. 1% (***), 5% (**), and 10% (*) present statistical significance levels. All variables are described in Table1. T-statistics are in parentheses.

Source: Authors own work.

5. Robustness checks

To further assess the robustness of our baseline findings, several robustness checks were ruled including alternative variable measurements and model specifications. Together, these robustness checks are designed to test the soundness of the baseline results from multiple perspectives and mitigate potential econometric concerns related to measurement error, endogeneity, and possible correlations in the errors both within firms over time and across firms in the same period.

5.1. Alternative measures of FS

Following Hossain *et al.* (2025), we employ several alternative measures of FS by replacing our baseline indicator with Return on Invested Capital (ROIC), proxied by the net operating profit after tax divided by invested capital, and the lagged total liabilities to total assets ratio (LTA). As Table 7 shows, ESG performance is positively associated with both indicators of FS, indicating that stronger ESG practices enhance firms' financial outcomes. These results confirm our main findings and further reinforce the robustness of the positive nature of the ESG performance–FS nexus, suggesting that this association is insensitive to alternative measures of FS.

Table 7. Alternative measures of FS

Variable	ROIC	LTA
ESG	0.5717** (1.90)	0.0231*** (4.64)
BRDSZ	0.0268* (1.68)	0.00006** (2.20)
BRDIND	0.4953 (0.72)	0.0003 (0.03)
BRDG	2.0477*** (3.83)	0.0181** (2.00)
FSIZ	−0.1606** (−2.37)	−0.0138*** (−13.45)
WCP	−0.2557 (−1.11)	−0.0055 (−1.35)
ROE	1.0575*** (11.57)	0.0825*** (64.01)
Constant	7.1921*** (4.07)	1.1688*** (42.73)
Observations	2916	2916

Variable	ROIC	LTA
F-statistic	32.79***	763.93***
Adjusted R ²	0.1027	0.6862

Notes: This table displays the empirical results of estimating the alternative FS measures. Column (1) uses return on invested capital (ROIC), whereas Column (2) uses the ratio of total liabilities to total assets (LTA). Industry and year fixed effects are included. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table 1. T-statistics are in parentheses.

Source: Authors own work.

5.2. Alternative measures of CCRE

As an alternative measure of firm-level CCRE, we use the disaggregated subcomponents of Sautner *et al.*'s (2023a) measure to capture distinct dimensions of climate risk and opportunity. Specifically, we included climate-related opportunities (renewable energy), regulatory factors (climate policy), physical threats (greenhouse gas and CO₂ emissions), and operational energy considerations (energy use). These subcomponents allow us to examine how specific facets of climate change exposure differentially moderate the ESG performance-FS relationship through robustness analyses. The results shown in Table 8 show that ESG performance remains positive and highly significant across all models, indicating its direct role in enhancing FS. Column (1) shows that while GHGE has a negative effect, the interaction term (ESG*GHGE) is positive and significant, meaning that ESG performance mitigates the adverse impact of greenhouse gas emissions. Similarly, column (2) indicates that renewable energy opportunities negatively affect FS, but the ESG*RENEWABLE interaction is positive, reflecting ESG's moderating role. Column (3) shows a comparable pattern for energy use, and column (4) for climate policy exposure, where ESG alleviates the negative effects of these risk factors. In contrast, column (5) shows that CO₂ emissions have a strong negative impact, and the negative ESG*CO₂ interaction suggests that ESG performance may have a limited capacity to offset the risks associated with high carbon emissions. Overall, these findings highlight that ESG performance not only supports FS directly but also strategically helps firms manage diverse climate-related risks, with the effectiveness of this mitigation varying across different dimensions of exposure.

Table 8. Alternative measures of CCRE

Variables	(1)	(2)	(3)	(4)	(5)
ESG	0.1776*** (2.71)	0.1767*** (2.70)	0.1766*** (2.81)	0.1773*** (2.71)	0.1921*** (2.99)
GHGE	-0.6157*** (-3.43)				
ESG*GHGE	0.0104*** (2.64)				
RENENRGY		-0.9084*** (-3.45)			
ESG* RENENRGY		0.0412*** (2.81)			
ENRGYUSE			-0.9084*** (-3.45)		
ESG* ENRGYUSE			0.0412*** (2.81)		
ClimatePolicy				-0.6841*** (-3.43)	
ESG* ClimatePolicy				0.0169*** (2.69)	
CO2					-5.6012*** (-4.27)
ESG* CO2					-0.0046*** (-8.38)
BRDSZ	0.1957*** (3.24)	0.1956*** (3.23)	0.1956*** (3.23)	0.1957*** (3.24)	0.1849*** (3.06)
BRDIND	0.1608 (0.71)	0.1607 (0.71)	0.1607 (0.71)	0.1608 (0.71)	0.1108 (0.49)
BRDG	0.6246*** (4.64)	0.6238*** (4.63)	0.6238*** (4.63)	0.6244*** (4.64)	0.6216*** (4.65)
FSZ	-15.2303*** (-61.12)	-15.2317*** (-61.12)	-15.2317*** (-61.12)	-15.2307*** (-61.12)	-15.2541*** (-61.29)
WCP	-0.4726 (-4.15)	-0.4728 (-4.15)	-0.4728 (-4.15)	-0.4726 (-4.15)	-0.4820 (-4.24)
ROE	0.1496***	0.1497***	0.1497***	0.1496***	0.0418**

Variables	(1)	(2)	(3)	(4)	(5)
	(2.88)	(2.88)	(2.88)	(2.88)	(2.24)
Constant	48.7083***	48.4379***	48.4379***	48.5937***	47.2021***
	(53.01)	(54.63)	(54.63)	(53.72)	(57.07)
Observations	2,916	2,916	2,916	2,916	2,916
Groups	323	323	323	323	323
R² (within)	0.6347	0.6348	0.6348	0.6347	0.6358
F–statistic	428.07***	428.12***	428.12***	428.08***	430.04***

Notes: This table presents the empirical results using the disaggregated subcomponents of firm–level climate change exposure as moderators in the relationship between ESG performance and FS. Column (1) uses greenhouse gas emissions (GHGE), Column (2) uses renewable energy (REENERGY), Column (3) uses energy use (ENERGYUSE), Column (4) uses climate policy (ClimatePolicy), and Column (5) uses CO₂ emissions (CO₂). Industry and year fixed effects are included. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table 1. T–statistics are reported in parentheses.

Source: Authors own work.

5.3. Alternative estimation methods

To check the sensitivity of above results to estimation approaches inadequacy, the baseline model is re-estimated using a set of alternative econometric approaches designed to address potential concerns arising from the panel structure of the data, including cross-sectional dependence, serial correlation, and heteroscedasticity. Specifically, we employ the Driscoll–Kraay robust standard errors and the Fama–MacBeth two–step procedure to ensure reliable statistical inference. Additionally, we estimate Generalized Linear Models and Quantile Regressions to check whether the positive effect of ESG performance on FS holds under alternative functional forms and across different points of the outcome distribution. As shown in Table (9), results of the baseline models are hold demonstrating that the ESG performance–FS nexus is robust to different model specifications.

Table 9. Alternative estimation methods

Variable	Driscoll–Kraay robust standard error	GLM	Quantile	Fama–MacBeth
ESG	0.2415*** (2.85)	0.2496*** (7.65)	0.0774*** (10.89)	0.2902*** (6.19)
BRDSZ	0.0034 (1.08)	0.0176 (1.5)	0.0016** (2.25)	0.0179 (1.28)
BRDIND	0.1433** (1.97)	–0.1177	–0.0217	–0.2039**

Variable	Driscoll–Kraay robust standard error	GLM	Quantile	Fama–MacBeth
		(−0.95)	(−1.36)	(−2.20)
BRDG	0.6563** (2.16)	0.9945*** (2.95)	0.0118 (0.63)	0.6321*** (2.59)
FSIZ	−0.4948** (−2.46)	−0.2179*** (−4.5)	−0.0215*** (−10.94)	−0.1395** (−2.05)
WCP	−0.4009* (−1.66)	−0.0833 (−1.12)	0.03542 (1.24)	0.0423 (0.0447)
ROE	0.1973** (1.89)	0.9369*** (2.89)	0.1266*** (3.26)	0.2428*** (2.97)
Constant	10.823*** (2.40)	4.1046*** (3.93)	0.2422*** (5.81)	2.1478* (1.68)
Observations	2916	2916	2916	2916
F / Wald χ^2	125.74***	210.36***	89.87***	191.64***
Adjusted R²	0.3437		0.0473	

Notes: This table presents the empirical results obtained using the different estimation methods. Industry and year fixed effects are included. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table 1. T-statistics are in parentheses.

Source: Authors own work.

5.4. Endogeneity concerns

To further demonstrate that our initial results are not influenced by endogeneity bias arising from reverse causality, omitted variables or measurement errors, we apply an instrumental variable (IV) approach as well as a two-stage least squares (2SLS) analysis. Additionally, we use propensity score matching and entropy balancing methods to control for observable confounders and account for unobserved time and industry-specific heterogeneity.

5.4.1. Instrumental variable approach

In our baseline fixed-effects model, endogeneity concerns may still matter. To address these issues and account for the potential lagged effects of ESG performance, we follow the literature and employ the one-period lagged ESG variable (L.ESG) as an IV (Naseer *et al.*, 2024). We then conduct a two-stage least squares (2SLS) estimation as an alternative check. The first-stage results in shown in Table (10) confirm the validity of the instrumental variable, as indicated by the high F-statistic and substantial R-squared value, supporting instrument relevance. The second-stage (2SLS) estimates show that ESG performance remains positive and highly significant, providing strong evidence that ESG performance enhances firms' FS. Overall, these results indicate that

endogeneity does not drive the positive ESG performance–FS connection, supporting a causal interpretation and underscoring the strategic importance of ESG investments for sustainable financial outcomes.

Table 10. Endogeneity check

Variable	First–Stage	2SLS
ESG		0.2281*** (6.20)
L.ESG	0.9394*** (176.49)	
BRDSZ	0.0000 (0.05)	0.0152*** (4.42)
BRDIND	–0.0051 (–0.32)	–0.1035 (–1.01)
BRDG	0.0038** (2.28)	0.6371*** (7.17)
FSIZ	–0.0010 (–0.89)	–0.1625*** (–22.29)
WCP	–0.0106 (–1.39)	–0.0091 (–0.18)
ROE	0.0173*** (2.82)	0.4459*** (3.26)
Constant	0.2926*** (9.33)	2.8907*** (13.79)
Observations	2,916	2,916
F / Wald χ^2	4796.52***	596.33***
R squared	0.9296	0.1897

Notes: This table presents the effect of ESG performance on FS using 2SLS method. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table1. T–statistics are in parentheses.

Source: Authors own work.

5.4.2. Propensity score matching and entropy balancing analysis

To check for differences in firm characteristics effects, we applied propensity score matching (PSM) and entropy balancing approaches. The treatment group consists of firms with an ESG score above the median ESG score. However, their counterparts with scores below the median were

assigned to the control group. A Probit model including all control variables from our baseline model predicts the likelihood of high ESG performance, and propensity scores are calculated for each firm–year. Firms are then matched using both nearest neighbor and kernel matching with a 0.01 caliper. Results in Table (11) show that the treatment group shows significantly higher ESG performance under nearest neighbor (0.0941, $t=5.75$) and kernel matching (0.0777, $t=4.72$), confirming the robustness of the positive effect of ESG performance on FS. This method allows for the comparison of similar firms with differing ESG performance, reducing endogeneity and mitigating sample selection bias.

Table 11. Propensity score matched regression analysis

Variable	Nearest Neighbor	Kernel Matching
High ESG (Treatment)	0.0941*** (5.75)	0.0777*** (4.72)
BRDSZ	0.0076** (2.42)	0.0077** (2.44)
BRDIND	0.0230 (0.23)	−0.0206 (−0.21)
BRDG	0.7733*** (9.86)	0.7570*** (9.54)
FSIZ	−0.1390*** (−21.67)	−0.1468*** (−22.53)
WCP	−0.0558 (−1.27)	−0.06997 (−1.60)
ROE	0.6280*** (4.96)	0.5245*** (4.17)
Constant	3.1117*** (19.62)	3.3410*** (20.94)
Adjusted R²	0.1751	0.1861
Weighted Regression	Yes	Yes
Notes: This table displays the results of propensity score matching analysis. 1% (***), 5% (**), and 10% (*) present statistical significance levels. All variables are described in Table 1. T-statistics are in parentheses.		
Source: Authors own work.		

Table 12 displays the results of the entropy–balancing analysis. This method rebalances the unit weights in our sample so that the covariate distribution is similar for both the treatment and control

groups which include firms with ESG performance above and below the median ESG score, respectively. Entropy balancing has an advantage over traditional propensity–score matching, as it retains the full sample by equating the moments of covariates among the treatment and control groups instead of discarding units. In particular, this approach can balance not only the first and second moments, means and variances but also higher–order moments, which enhances covariate balance and reduces potential biases in the estimates. By doing so, we reduced the inequality in the covariate distributions and strengthened the robustness of our causal inference.

The results in Panel A show that before entropy balance matching, the treatment and control groups exhibit noticeable differences in mean, variance, and skewness across several covariates. After applying entropy balance matching, the covariate distributions in the treatment and control groups were almost identical. The mean, variance, and skewness for all variables were equal between the two groups, indicating that the matching successfully balanced the first, second, and third moments of the covariate distributions. Panel C reports entropy–weighted regression results. The coefficient of ESG variable is positive and statistically significant (0.2281, $t=6.20$), indicating that the positive association between ESG performance and FS is preserved even after controlling for self–selection bias.

Table 12. Entropy Balancing analysis

Panel A. Before Entropy Balance Matching						
Variable	Treatment			Control		
	Mean	Variance	Skewness	Mean	Variance	Skewness
BRDSZ	11.19	10.67	12.84	10.84	9.036	11.466
BRDIND	0.8484	0.0077	–1.693	0.8251	0.0104	–1.404
BRDG	0.2646	0.0146	1.462	0.2226	0.01045	1.1992
FSIZ	23.93	2.23	–0.7539	23.56	2.706	–0.677
WCP	0.3036	0.0356	0.7133	0.2901	0.0392	0.7031
ROE	0.0820	0.0053	1.964	0.0814	0.0052	1.951
Panel B. After Entropy Balance Matching						
Variable	Treatment			Control		
	Mean	Variance	Skewness	Mean	Variance	Skewness
BRDSZ	11.19	10.6701	12.8400	11.19	10.6631	12.8360
BRDIND	0.8484	0.0077	–1.6930	0.8484	0.0077	–1.6921
BRDG	0.2646	0.0146	1.4620	0.2646	0.01468	1.4610

FSIZ	23.93	2.23	−0.7539	23.93	2.23	−0.7537
WCP	0.3036	0.0356	0.7133	0.3036	0.0356	0.7121
ROE	0.0820	0.0053	1.9640	0.0820	0.0053	1.9637
Panel C. Entropy Weighted Regression Results						
Variable	Coefficient					
ESG	0.2281*** (6.20)					
BRDSZ	0.0152*** (4.42)					
BRDIND	−0.1035 (−1.01)					
BRDG	0.6371*** (7.17)					
FSIZ	−0.1625*** (−22.29)					
WCP	−0.0091 (−0.18)					
ROE	0.4459*** (3.26)					
Constant	2.8907*** (13.79)					
Firm_FE	Yes					
Industry_FE	Yes					
Observations	2,916					
F_statistic	596.33***					
Adjusted R²	0.1897					

Notes: This table displays the results of the entropy balancing analysis. 1% (***), 5% (**), and 10% (*) indicate statistical significance levels. All variables are described in Table1. T-statistics are in parentheses.

Source: Authors own work.

6. Conclusion, implications, and limitations

This study aims to investigate the ESG performance-FS nexus across S&P500 non-financial firms for the period 2015–2023 while incorporating CCRE as a moderating factor. Based on stakeholder, signaling, and resource-based theories, it provides comprehensive empirical evidence on how

sustainability-oriented strategies interact with climate-related risks to shape long-term financial resilience.

The findings revealed that ESG performance significantly enhances FS. That is, firms with stronger ESG engagement demonstrated improved profitability and solvency, confirming that sustainability initiatives contribute to long-term value creation and financial stability. The analysis of individual ESG pillars further shows that the ESG dimensions positively influence FS, emphasizing the multidimensional nature of ESG-driven performance.

However, the results also indicate that CCRE mitigates the ESG performance-FS nexus. Firms facing higher physical and transition risks experience financial pressure that weakens their resilience. More importantly, climate risk significantly moderated the ESG performance-FS relationship. Specifically, the positive effect of ESG performance diminishes with exposure to high climate risk. This finding suggests that ESG engagement alone may not fully offset the adverse financial consequences associated with substantial climate-related vulnerability.

Robustness tests grounded in alternative proxies, estimation approaches and endogeneity controls confirm the stability of the results. Overall, the study concludes that ESG performance is a strategic driver of FS, yet its effectiveness critically depends on firms' ability to manage climate-related risks.

6.1. Theoretical and practical implications

From a theoretical standpoint, this study extends stakeholder theory by demonstrating that the financial benefits of ESG practices are conditional rather than universal. Although ESG performance enhances firm value, external environmental risks constrain its effectiveness. This contingency perspective enriches the ESG literature by integrating environmental risk exposure into the sustainability–performance framework.

The findings also contribute to signaling theory by showing that ESG performance signals strong governance and risk management capabilities. However, when climate risk exposure is high, this signaling effect weakens suggesting that stakeholders differentiate between symbolic ESG engagement and substantive climate resilience.

Under the resource-based perspective, ESG responsibilities represent valuable strategic resources that enhance long-term competitiveness. However, their performance impact depends on firms' capacity to manage external environmental threats. Thus, sustainability must be embedded within broader risk management systems.

The results highlight that managers should align ESG strategies with proactive climate risk management. ESG disclosure alone is insufficient to ensure financial resilience. Firms must

integrate climate adaptation measures, carbon reduction strategies, scenario planning, and climate governance mechanisms into their sustainability framework.

For policymakers and regulators, the findings underscore the need for standardized climate risk reporting and stronger ESG disclosure requirements. Enhanced transparency can reduce information asymmetry and facilitate a more efficient capital allocation for climate-resilient firms. For investors, the results emphasize the importance of evaluating ESG performance in conjunction with climate risk exposure. ESG scores should not be interpreted in isolation but should be assessed alongside firms' vulnerability to environmental risks.

6.2. Limitations and future research directions

This study has several limitations that may encourage further investigations. First, the sample is limited to S&P500 non-financial firms, which impede its generalizability. Future studies could examine smaller firms, financial institutions, or companies in emerging markets to determine whether institutional environments influence the ESG–FS nexus.

Second, CCRE was measured using available proxies that may not fully capture firm-specific physical and transition risks. Future research could incorporate more granular and forward-looking measures, including carbon intensity, geographic exposure to extreme weather events, and climate scenario analysis.

Third, the study relies on quantitative secondary data fails not capture qualitative scopes such as managerial commitment, climate risk management efficiency, or strategic integration of ESG practices. Future research should adopt mixed-method approaches, including case studies and surveys, to explore these mechanisms in greater depth.

Fourth, the analysis assumed a linear relationship. Future research could investigate the nonlinear dynamics, threshold effects, or diminishing returns of ESG investments under varying levels of climate risk exposure.

Finally, future studies are called to explore additional mediating or moderating variables, such as green innovation, sustainable financing access, board expertise in climate issues, and regulatory stringency, to further clarify the mechanisms through which ESG performance influences FS.

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