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Can ESG Performance Improve Corporate Resilience? - An Empirical Study based on A-Share Listed Companies

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Abstract: In the context of the enhanced development of global sustainable investment, ESG rating accelerates the transformation of corporate governance systems. We choose Shanghai and Shenzhen's listed companies in the period of 2011-2023 as the sample, establish a two-way fixed effects regression model to examine the effect of corporate ESG performance on corporate resilience and the mechanism, and come to the conclusion that corporate ESG performance can effectively promote corporate resilience, and the conclusions are robust to a series of robustness checks and endogeneity checks. Further mechanism analysis finds that corporate resilience is promoted by corporate ESG performance through enhancing the quality of human capital, the quantity of government subsidies, and green innovation performance. Heterogeneity checks indicate the effect of enhancing corporate resilience by corporate ESG performance is heterogeneous in different types of enterprises. This promoting effect is more significant in enterprises owned by the state, better internal control quality, and inferior external auditors' quality. This research supports the legitimacy of the role of corporate ESG performance in promoting corporate resilience, deepens empirical study on the micro effects of corporate ESG performance, and provides empirical support for the formulation of corporate strategies and the upgrade of China's policy system.

Keywords: ESG Performance; Enterprise Resilience; Fixed Effect Model; Mechanism Test; Heterogeneity Analysis

1. Introduction

With the rapid development of the global economy, the business environment is growing more complicated and volatile, posing both opportunities and challenges to enterprises. Environmental, Social, and Governance (ESG) factors, being the crucial indicators of sustainable development, are becoming a core issue of corporate strategy. Emerging from the concept of Corporate Social Responsibility (CSR), ESG was initially proposed in the United Nations' "Who Cares Wins" report in 2004. With environmental movements and international laws intensifying globally, ESG developed as a crucial framework for assessing corporate sustainability (Huang, 2021)[1]. With increasing growth in sustainable investment, ESG performance caught the eye of regulators, investors, and enterprises, leading to many adding ESG into crucial decisions like investments (Gao et al., 2021)[2]. China's "Dual Carbon" program fits in aptly with the principles of ESG, supporting favorable market and policymaking opportunities (Xi & Zhao, 2022). In 2018, the China Securities Regulatory Commission (CSRC) mandated listed companies to give disclosures on Environment, Social, and Governance (ESG), the beginning of institutionalizing the disclosure of ESG reports. In the Asset Management Association of China's 2019 Report on ESG Evaluations, a systematic framework template was given, and in the China ESG Development White Paper in 2020, the status and future of ESG in China were defined, calling upon further development of the capital market. This background emphasizes the necessity of probing the question of how and to what degree corporate capabilities can be enhanced by ESG performance[3].

Corporate resilience, a crucial competency to cope with external shocks, is being viewed with more interest by both academia and the business sector (Zhang et al., 2022)[4]. Resilience is defined as the ability of an enterprise to change, carry on, and bounce back rapidly in the aftermath of crises (Gilberto, 2006)[5]. Rather than shying away from risks, society needs to increase corporate resilience in order to manage uncertainties (Wildavsky, 1988)[6]. Vogus and Sutcliffe (2007) also underscore the necessity of empirical studies on drivers of organizational

resilience. Corporate resilience's potential effects caused by ESG performance are a subject of growing interest both for scholars and investors. Analyzing the economic effects of ESG on resilience, the mechanisms of action, and its diverse effects in different situations have both theoretical and practical implications.

Strong ESG performance was found to enhance financial and market competitiveness (Eccles et al., 2014; Hong & Kacperczyk, 2009)[7,53]. Nevertheless, the majority of extant studies investigate the direct impact of ESG on financial performance, and there is limited empirical evidence examining the role of ESG in enhancing performance through corporate resilience. In spite of the existence of a positive correlation between resilience and ESG ratings, the underlying mechanism is not adequately investigated. Employing a sample of listed companies in A-shares from the period of 2011-2023, the empirical findings indicate that the performance of ESG improves corporate resilience, a finding supported by different test processes. Mechanism analysis shows that resilience is enhanced by the quality of human capital, the increase in government subsidies, and the quality of green innovation. Heterogeneous test results indicate that the effect is heterogeneous in different types of enterprises, being more pronounced in the case of state-owned enterprises, enterprises with improved internal control, and enterprises having low quality of external audit.

This study's contributions include: ① examining how ESG performance enhances corporate resilience, applicable not only post-shock but in general, making the findings widely relevant. ② analyzing the mechanisms linking ESG performance to resilience, providing insights into human capital, government subsidies, and green innovation, thereby offering a basis for improving ESG practices. ③ exploring the impact of enterprise differences, such as property rights, internal control, and audit quality, on resilience enhancement.

2. Literature Review and Research Hypothesis

2.1 Literature Review

2.1.1 Corporate ESG Performance.

In the era of sustainable development, ESG principles have garnered significant attention globally. Research on corporate ESG performance can be divided into two areas: the factors influencing ESG performance and its economic consequences. Economically, ESG performance can impact business operations in the long term. Strong ESG performance can enhance corporate value through multiple channels, including easing financing constraints, improving operational efficiency, and increasing market attention (Li et al., 2021; Wang & Yang, 2022)[8,52]. It also promotes innovation, both in quantity and quality (Fang & Hu, 2023)[9]. Furthermore, improved ESG disclosure can mitigate the risk of stock price crashes (Xi & Wang, 2022)[10]. ESG ratings have been shown to reduce shareholder hollowing out and capital occupation hollowing out (Li et al., 2025)[11]. Exceptional ESG performance can raise employment levels and enhance the effective allocation of labor resources (Mao & Wang, 2023)[12]. Regarding influencing factors, internal governance characteristics can have varying effects on ESG performance, including the impact of executives' narcissism and party organization governance (Shan et al., 2025; Liu et al., 2022)[13]. Digital transformation can enhance corporate ESG performance (Wang et al., 2023)[14]. External policy pressures, such as environmental protection taxes, can drive ESG practices through green technology innovation (Wang et al., 2021)[15]. Additionally, the heterogeneity of companies-such as ownership type, industry attributes, and regional marketization levels-can lead to differentiated ESG effects. For example, state-owned enterprises are more likely to optimize governance structures due to stricter policy compliance requirements (Xue et al., 2022)[20], while non-polluting industries rely less on external regulatory pressure and are more dependent on ESG ratings to curb "greenwashing" (Xu et al., 2025)[16].

2.1.2 Corporate Resilience.

In recent years, the issue of "resilience" in enterprises or organizations has become a research hotspot in domestic academia, with abundant related findings (Li et al., 2024)[17]. These studies cover areas such as conceptual connotations, indicator measurement, and empirical research. Scholars have used several measurement methods: field investigations and questionnaires to gather primary data; external shock analysis to assess resistance and recovery capabilities under event impacts; and disclosure

metric measurement, using financial indicators like profit growth and return on assets, or market indicators such as stock returns and volatility. Empirical studies have found that digital transformation (Zhang & Deng, 2023; Luo et al., 2024)[18,54], heterogeneous government subsidies (Feng & Zhu, 2024)[19], and shareholder relationship networks (Luo & Zhai, 2023) influence corporate resilience. Studies have shown that good ESG performance can significantly enhance organizational or corporate resilience. For example, Liu and Xu (2024) found that ESG boosts resilience through various pathways, such as enhancing market competitiveness, reducing financing costs, improving corporate reputation, and strengthening risk resistance. Lai et al. (2024) pointed out that ESG not only directly enhances resilience but also indirectly improves internal governance and enhances trust among external stakeholders. Chen et al. (2024) emphasized that the impact of ESG on resilience varies across industries and regions, especially in high-carbon sectors where the effect is more pronounced. Additionally, Wang and Hu (2024) found that corporate ESG performance can indirectly enhance supply chain resilience by improving supply chain coordination and risk management.

2.2 Research Hypothesis

To explore the relationship between corporate ESG performance and resilience, this study grounds its hypotheses in established economic and management theories, including stakeholder theory (Freeman, 1984), the resource-based view (RBV), and institutional theory. These frameworks provide a robust foundation for understanding how ESG practices enhance corporate resilience by aligning with stakeholder expectations, leveraging internal resources, and responding to institutional pressures. The hypotheses are developed to test the direct impact of ESG performance on resilience and the underlying mechanisms driving this relationship[50].

Stakeholder theory posits that firms prioritizing stakeholder interests, such as those of employees, customers, and communities, can build trust and secure critical support during crises (Freeman, 1984). ESG practices, encompassing environmental stewardship, social responsibility, and robust governance, align with this theory by fostering stakeholder loyalty and cooperation. For instance, environmental initiatives enhance consumer loyalty, while employee welfare programs strengthen workforce commitment during economic downturns[51]. Additionally, the resource-based view suggests that ESG performance cultivates intangible assets, such as reputation and organizational legitimacy, which enhance a firm's ability to adapt and recover from external shocks. Institutional theory further supports this by highlighting how ESG compliance with regulatory and societal expectations mitigates risks and stabilizes operations in volatile environments. Collectively, these theories suggest that proactive ESG practices bolster corporate resilience by improving adaptability and stakeholder support. Thus, the study proposes:

H1: Given other conditions remain constant, corporate ESG performance significantly improves corporate resilience.

Human capital, encompassing the skills, knowledge, and expertise of employees, is a critical driver of corporate development and resilience during crises (Li & Nie, 2002)[21]. The resource-based view (RBV) posits that human capital is a strategic asset that enhances a firm's competitive advantage and adaptability. ESG performance, particularly through social responsibility initiatives, strengthens human capital by attracting and retaining high-quality talent (Edmans, 2011). For example, firms with strong employee welfare programs, as part of their ESG practices, foster loyalty and motivation, enabling better responsiveness to market volatility (Xu & Wang, 2010)[22]. Stakeholder theory further supports this mechanism, as ESG-driven investments in employee development align with the interests of internal stakeholders, enhancing organizational cohesion and crisis management capabilities (Freeman, 1984). By improving the quality and commitment of human capital, ESG practices enable firms to navigate uncertainties effectively, thereby boosting resilience. Thus, the study proposes:

H2: ESG performance enhances corporate resilience by improving human capital.

Government subsidies serve as a critical external resource for firms facing crises, providing financial relief and supporting operational stability (Zeng et al., 2019)[23]. Institutional theory suggests that firms aligning with governmental priorities, such as sustainability and social responsibility, are more likely to gain institutional support, including subsidies. Strong

ESG performance signals compliance with environmental and social regulations, enhancing a firm's legitimacy and attractiveness to policymakers. This alignment facilitates access to government subsidies, which alleviate financial constraints and bolster resilience during economic shocks. Stakeholder theory complements this perspective by emphasizing that ESG practices strengthen relationships with external stakeholders, including government entities, further increasing subsidy opportunities (Freeman, 1984). By securing greater financial support, ESG performance enhances a firm's capacity to withstand crises. Thus, the study POSes:

H3: ESG performance enhances corporate resilience by increasing government subsidies.

Green innovation, encompassing the development of environmentally friendly technologies and processes, is a key component of ESG performance (Schiederig et al., 2016)[24]. The resource-based view (RBV) posits that green innovation generates unique capabilities, such as sustainable competitive advantages, which enhance a firm's ability to adapt to environmental and market changes (Ju et al., 2008)[25]. ESG performance drives green innovation by increasing investments in research and development (R&D) for eco-friendly technologies, as evidenced by the positive impact of ESG disclosure on innovation outcomes (Xiang & Wei, 2022)[26]. Stakeholder theory further suggests that ESG-driven green innovation aligns with the expectations of external stakeholders, such as consumers and regulators, enhancing corporate reputation and market legitimacy (Freeman, 1984). These innovations not only reduce environmental risks but also strengthen a firm's resilience by fostering long-term competitiveness and adaptability. Thus, the study proposes:

H4: ESG performance enhances corporate resilience by improving green innovation performance.

3. Research Design

3.1 Data Sources

Based on the research content and design, this paper selects corporate data from A-share listed companies between 2011 and 2023 as the research sample, and processes the data as follows: First, remove financial company samples; Second, remove ST, *ST, and PT company samples; Third, exclude samples with missing key variables. The data mainly comes from the WIND database and the CMSAR database, where the Huazheng ESG data is sourced from the Wind Info Financial Terminal, and the financial data of other listed companies are all from the CSMAR database.

3.2 Model Construction

In order to study the impact of ESG performance on enterprise resilience, considering individual effect and time effect, this study constructs the following fixed effect regression model according to hypothesis 1.

$$toughness_{i,t}=\alpha_0+\alpha_1 ESG_{i,t}+\alpha_2 Contorl_{i,t}+\mu_t+\tau_i+\varepsilon_{i,t} \quad (1)$$

Among them, i and t represent different industries and years respectively. i $toughness\mu_t,\tau_i$ and t represent the resilience level of enterprises in industry i in year t, ESG i, t represents the ESG performance of industry i in year t, Contorl i, t represents all control variables, which respectively represent industry fixed effects and year fixed effects, ε is the random disturbance term, industry represents industry, and year represents year[28].

3.3 Indicator Selection

1. Dependent Variable: Firm Resilience (toughness). Referencing measures of firm resilience by academic scholars like Wu Xiaobo and Feng Xiaoya (2022), Liu Bin and Tan Shuqi (2022), and Chen Qi and Li Menghan (2024), this research assesses firm resilience in two ways: long-term growth and financial volatility. It surmounts the challenges in gathering field survey data and the temporal constraints in measuring external shocks. Cumulative sales revenue growth in three years serves as the positive indicator of long-term growth, and the standard deviation of stock returns in every month of a year is the negative indicator of financial volatility. Entropy weighting method assesses the degree of firm resilience, and the composite score is scaled up by a factor of 10[29].

2. Explanatory Variable: Corporate ESG Performance (ESG). Following the research approach of Fang Xianming and Hu Ding (2023) and other scholars, this paper uses the Huazheng ESG score from the Wind database as the core explanatory variable. The Huazheng Index categorizes corporate ESG scores into nine levels from highest to lowest: AAA, AA, A, BBB, BB, B, CCC, CC, C. For this study, a

nine-point scale is adopted to assign values to the annual ESG performance of companies, with each level being assigned a score from 1 to 9[30].

3. Group Variables: To conduct heterogeneity analysis, this paper sets up three group variables, including whether listed companies are state-owned enterprises (property), internal control quality (Isvalid), and external audit quality (Big4). The specific definitions of these three group variables are as follows: ① If the actual controller of a company is a state-owned enterprise, administrative institution, public institution, central government agency, or local government agency, the sample is classified as a state-owned enterprise; otherwise, it is classified as a non-state-owned enterprise. When a company is a state-owned enterprise, property is 1; otherwise, it is 0; ② Internal control quality is defined based on whether the internal controls of a company are effective according to the Guotai An database. Isvalid is 1 if the internal control quality is high, and 0 if it is poor; ③ The external audit quality of a company is defined using the method proposed by Chen Shaokai and Jia Shuaishuai (2025) and other scholars. When a company is audited by one of the Big Four international accounting firms, Big4 is 1; if it is not audited by any of the Big Four, Big4 is 0[31].

4. Mechanism variables:

Level of human capital (Human): In accordance with the practices of Liu Qiren and Zhao Can (2020), Zhao Chenyu (2021), Ye Yongwei et al. (2023), in this study, the proportion of college degree or above people in enterprises is adopted as the index of the level of human capital of enterprises, and the greater the ratio, the greater the enterprise's level of human capital[32].

Government Subsidy (Sub): An enterprise's good ESG performance can assist the enterprise in achieving government subsidies and other governmental support (Zeng et al., 2019)[27]. Following the approach of Wan Jia Yu et al. (2020), this paper employs the natural logarithm of the government subsidy received by the enterprise in the present year as a proxy of the government subsidy received by the enterprise.

Green innovation performance (Green): Based on the empirical techniques of Fang Xianming (2020), Chen Xiaoshan and Liu Hongduo (2023) and other experts, and given the data availability, the green innovation performance of enterprises in this study is measured by using the natural logarithm of the combined sum of the count of green invention and green utility models applied individually by the enterprises in the present year plus 1[33].

5. Control variables: A series of indicators such as enterprise size Size, listing period Age, corporate debt ratio Lev, intangible assets ratio Int, employee density Staff, management expense ratio Mfee, board size Board, shareholder holding ratio Top1 and management holding ratio Mshare were selected as control variables in the study. See Table 1 for the specific variable description[34].

Table 1. Variable Definitions

type of variable	Variable name	Variable code	Indicator selection
explained variable	Enterprise resilience	toughness	The entropy weighting method was used to calculate the cumulative sales revenue growth (billion yuan) and the standard deviation of monthly stock return rate within three years
explanatory variable	Corporate ESG performance	ESG	The nine grades of the China Securities Index ESG are assigned a score of 1 to 9 according to this.
Mechanism variables	Human capital level	Human	College degree or above personnel / total personnel
	public subsidy	Sub	The natural logarithm of the government subsidy received by the enterprise in that year
	Green innovation performance	Green	The number of green inventions and green utility models independently applied by enterprises in the same year is added to take the natural logarithm
controlled variable	scale	Size	The logarithm of the total assets of an enterprise at the end of the year

	Listing period	Age	The logarithm of the number of years a company has been listed plus 1
	Corporate debt ratio	Lev	Total liabilities/total assets
	Ratio of intangible assets	Int	Net intangible assets/total assets
	Staff density	Staff	Number of employees/Operating income (million yuan)
	Administrative expense ratio	Mfee	Administrative expenses/revenue
	Size of the board	Board	The number of board members is the logarithm
	The largest shareholder shareholding ratio	Top1	Number of shares held by the largest shareholder / total number of shares
	management layer shareholding ratio	Mshare	Number of shares held by management / total number of shares

Table 2. Descriptive Statistics of Relevant Variables

Variable	sample capacity	average value	median	standard error	least value	crest value
toughness	33706	8.798	8.968	0.648	7.108	9.743
ESG	33706	4.157	4.000	1.026	1.000	8.000
human	33706	27.980	22.000	21.850	0.000	89.270
Sub	33706	16.140	16.260	1.859	10.240	20.440
Green	33706	0.350	0.000	0.756	0.000	3.584
Size	33706	22.300	22.110	1.309	20.010	26.360
Age	33706	2.199	2.303	0.838	0.000	3.401
Lev	33706	0.426	0.418	0.203	0.056	0.895
Int	33706	0.046	0.033	0.050	0.000	0.318
Staff	33706	1.271	1.031	0.988	0.067	5.350
Mfee	33706	0.102	0.074	0.098	0.007	0.620
Board	33706	2.120	2.197	0.196	1.609	2.639
Top1	33706	33.770	31.430	14.860	8.200	74.020
Mshare	33706	13.040	0.664	19.080	0.000	67.480

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Table 2 reports the descriptive statistics of the primary variables in this study. It can be seen that the mean of the outcome variable, firm resilience (toughness), is 8.798, and its standard deviation is 0.648, reflecting that the sample of firms have different levels of resilience. The mean of the explanatory variable, firm ESG performance (ESG), is 4.157, the maximum and minimum being 8 and 1, respectively, and its standard deviation equals 1.026, reflecting the considerable difference in ESG performance among the firms[35].

4.2 Regression Results and Analysis

Table 3 reports the benchmark regression estimates of the effect of ESG performance on corporate resilience. Column (1) includes no control variables and includes only year and industry fixed effects. In Column (1), the regression coefficient of the core explanatory variable, the corporate resilience (toughness), is, however, 0.023 and highly significant at the 1% level. Column (2) includes company-level control variables, and the regression coefficient of toughness is 0.015 and highly significant at the 1% level. These findings suggest that more favorable ESG ratings are associated with increased corporate resilience, corroborating Hypothesis 1. Regression estimates of the sub-dimensions of ESG in Columns (3), (4), and (5) indicate that the three dimensions are highly significant at the 1% level, and of the three, social responsibility (S) outweighs the other two in its effect on resilience, followed by corporate governance (G), and lastly, environmental factors (E)[36].

4.3 Robustness Test

1. Heckman Two-Stage Model. Given that this study only covers listed companies with ESG

ratings and does not include companies without ratings, there may be a sample selection bias. To address this issue, the study employs the Heckman two-stage method for validation. First, a dummy variable ESG_Dummy is constructed based on the median ESG rating of companies, with control variables and instrumental variables (ESG_IV) used as covariates, fixed at annual and industry levels. The first stage regression is performed using Probit regression, and the inverse Mills ratio (imr) is calculated. Subsequently, imr is included in the second stage regression. The results of the two-stage regressions are shown in columns (1) and (2) of Table 4[37].

Table 3. Results of the Benchmark Regression

variable	(1)	(2)	(3)	(4)	(5)
	toughness	toughness	toughness	toughness	toughness
ESG	0.023***	0.015***			
	(0.002)	(0.002)			
E			0.003**		
			(0.001)		
S				0.008***	
				(0.001)	
G					0.007***
					(0.001)
Size		0.036***	0.040***	0.038***	0.039***
		(0.002)	(0.002)	(0.002)	(0.002)
Age		0.071***	0.068***	0.070***	0.069***
		(0.004)	(0.004)	(0.004)	(0.004)
Lev		-0.151***	-0.167***	-0.167***	-0.150***
		(0.010)	(0.010)	(0.010)	(0.011)
Int		-0.076*	-0.076*	-0.080**	-0.073*
		(0.039)	(0.039)	(0.039)	(0.039)
Staff		-0.000	-0.000	-0.001	-0.001
		(0.002)	(0.002)	(0.002)	(0.002)
Mfee		-0.049**	-0.059***	-0.053***	-0.054***
		(0.020)	(0.021)	(0.020)	(0.021)
Board		0.017*	0.016*	0.015	0.019*
		(0.010)	(0.010)	(0.010)	(0.010)
Top1		0.000**	0.000***	0.000***	0.000**
		(0.000)	(0.000)	(0.000)	(0.000)
Mshare		0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Constant	8.703***	7.798***	7.782***	7.793***	7.761***
	(0.007)	(0.044)	(0.044)	(0.044)	(0.043)
Cluster to enterprise	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
sample capacity	33,705	33,705	33,705	33,705	33,705
Adj R^2	0.815	0.826	0.826	0.826	0.826

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

2. Proportional Score Matching (PSM). Based on the ESG mean of the same year and industry, the sample is divided into an experimental group and a control group, with the experimental group consisting of samples above the industry mean. Subsequently, the samples are paired using a 1:1 nearest neighbor matching method, and regression is performed again. The results are listed in column (1) of Table 5[38].

3. Substitute explanatory variables. This paper adopts the approach of Wang Bo and Yang Maojia (2022), using the mean of ESG ratings for four quarters in a year from the Huazheng

Index (ESG1) to replace the annual ESG rating (ESG) of companies; and using the median of quarterly ESG ratings within a year from the Huazheng Index (ESG2) and the comprehensive ESG score provided by the Wind database (ESG3) to replace the explanatory variables in regression analysis. The results are shown in columns (2), (3), and (4) of Table 5. The above tests confirm that the conclusions drawn in this paper are reliable, with the results of Hypothesis 1 being relatively robust[39].

Table 4. Robustness test -Heckman Test

variable	(1)	(2)
	ESG_Dummy	toughness
ESG		0.011***
		(0.002)
ESG_IV	1.454***	
	(0.032)	
imr		-0.011***
		(0.003)
Constant	-13.716***	7.874***
	(0.540)	(0.049)
controlled variable	yes	yes
Cluster to enterprise	yes	yes
Time fixed effects	yes	yes
Industry fixed effects	yes	yes
sample capacity	33,693	33,693
Pseudo R2 or Adj R2	0.245	0.826

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

Table 5. Robustness Test -PSM Method, Replacement of Explanatory Variables

variable	PSM law	Replace explanatory variables		
	(1)	(2)	(3)	(4)
	toughness	toughness	toughness	toughness
ESG	0.013***			
	(0.002)			
ESG1		0.017***		
		(0.002)		
ESG2			0.016***	
			(0.002)	
ESG3				0.002***
				(0.000)
Constant	8.344***	7.801***	7.800***	7.662***
	(0.150)	(0.044)	(0.044)	(0.047)
controlled variable	yes	yes	yes	yes
Cluster to enterprise	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
sample capacity	24,933	33,705	33,705	33,705
Adj R2	0.850	0.826	0.826	0.826

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

4.4 Endogeneity Test

Table 6. Endogeneity Test-Instrumental Variable Method

variable	Instrumental variable method	
	(1) The first stage	(2) The second stage
	ESG	toughness
ESG		0.026***
		(0.003)
ESG_IV	0.901***	
	(0.012)	
controlled variable	yes	yes
Cluster to enterprise	yes	yes
Time fixed effects	yes	yes
Industry fixed effects	yes	yes
sample capacity	33,705	33,705
Kleibergen-Paap rk LM	888.105***	
Kleibergen-Paap rk Wald F	5959.740	

1. Improved ESG performance enhances risk resilience and operating stability, lowering financial volatility, while more resilient companies tend to embrace ESG practices, indicating bidirectional causality. In order to

alleviate endogeneity, the current study employs the same-year, same-industry, and same-province ESG mean as the instrumental variable (ESG_IV), in line with Wu Peng et al. (2023), and employs two-stage least squares (2SLS)[41]. Table 6 outputs indicate the significant positive coefficient at the 1% significance level. Kleibergen-Paap rk LM and Wald F tests validate the validity of the instrument, and robust conclusions are ensured following the correction of endogeneity.

2. To mitigate omitted variables and reverse causality, ESG performance was regressed with one- and two-period lags. Table 7, columns (1) and (2), show both lagged coefficients as significantly positive at the 1% level, confirming ESG's sustained positive impact on corporate resilience and its role in fostering long-term sustainable development[40].

Table 7. Endogeneity Test-Lagged Explanatory Variables

variable	Delay the explanatory variables	
	(1)	(2)
	toughness	toughness
L1.ESG	0.011***	
	(0.002)	
L2.ESG		0.009***
		(0.002)
Constant	7.953***	8.042***
	(0.043)	(0.045)
controlled variable	yes	yes
Cluster to enterprise	yes	yes
Time fixed effects	yes	yes
Industry fixed effects	yes	yes
sample capacity	28,676	25,606
Adj R2	0.865	0.779

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

5. Further Analysis: Mechanism Test and Heterogeneity Analysis

5.1 Mechanism Test

The regression results mentioned earlier confirm the positive impact of corporate ESG performance on business resilience. In the theoretical analysis, this study points out that this positive effect is due to how corporate ESG performance enhances human capital levels, boosts green technology innovation, and increases government subsidies received, thereby promoting an improvement in business resilience. To enhance the reliability and authority of the research conclusions, further tests will be conducted to examine how corporate ESG performance improves human capital levels, green technology innovation, and the amount of government subsidies received[42].

Corporate ESG performance enhances human capital.

Column (1) of Table 8 shows a regression coefficient of 0.685 for ESG performance (ESG) on human capital (human), significant at the 1% level. This indicates a positive correlation between better ESG performance and higher human capital. Companies with strong ESG performance prioritize employee welfare and development, attracting top talent, improving adaptability, and boosting resilience. Studies also show that executive human capital significantly impacts organizational resilience (Hu et al., 2021), supporting Hypothesis 2[43].

Corporate ESG performance increases government subsidies.

Table 8. Mechanism Test

	(1)	(2)	(3)
variable	human	Sub	Green
ESG	0.683***	0.090***	0.068***
	(0.158)	(0.012)	(0.007)
Constant	-4.361	-1.526***	-3.011***
	(5.316)	(0.334)	(0.289)
controlled variable	yes	yes	yes
Cluster to enterprise	yes	yes	yes
Time fixed effects	yes	yes	yes
Industry fixed effects	yes	yes	yes
sample capacity	33,705	33,705	33,705
Adj.R2	0.497	0.320	0.188

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

Column (2) of Table 8 shows a regression coefficient of 0.090 for ESG performance (ESG) on government subsidies (Sub), significant at the 1% level. This suggests that better ESG performance leads to more government subsidies, as companies align with stakeholder expectations, attracting more financial support (Zeng et al., 2019). These subsidies enhance

competitiveness and resilience, verifying Hypothesis 3.

Corporate ESG performance enhances green innovation.

Column (3) of Table 8 shows a regression coefficient of 0.068 for ESG performance (ESG) on green innovation (Green), significant at the 1% level. Good ESG performance reduces information asymmetry, enhances reputation, and eases financing constraints, improving green innovation outcomes. This, in turn, strengthens corporate reputation, attracts stakeholders, and boosts resilience (Wang et al., 2025)[44], supporting Hypothesis 4.

5.2 Heterogeneity Analysis

This section examines the heterogeneity of ESG performance and corporate resilience enhancement based on property rights, internal control quality, and external audit quality.

1.Heterogeneity by Property Rights

Table 9, columns (1) and (2), show ESG performance effects on resilience across ownership types. Regression coefficients for state-owned and non-state-owned firms are significantly positive at the 1% level, indicating ESG enhances resilience in both. State-owned firms exhibit higher coefficients due to policy support and resource advantages, aligning ESG with national strategies[45].

2.Heterogeneity by Internal Control Quality

Internal control quality impacts ESG's effect on resilience. Table 9, columns (3) and (4), reveal that firms with better internal control quality show a significantly positive ESG-resilience coefficient at the 1% level, while poorer quality firms fail significance tests. Strong internal controls integrate ESG via risk warning and resource allocation, boosting resilience (Li Junzhen et al., 2022)[46].

3.Heterogeneity by External Audit Quality

External audit quality influences ESG-resilience dynamics. Table 9, columns (5) and (6), indicate that ESG's positive effect on resilience is significant at the 1% level for non-Big Four audited firms, but weaker for Big Four audited firms. High-quality audits enhance supervision and transparency, partially substituting ESG's governance role and reducing its marginal resilience contribution (Zhang Zennan et al., 2024)[47].

Table 9. Heterogeneity Analysis

	toughness					
	(1)	(2)	(3)	(4)	(5)	(6)
variable	Non-state enterprise	belong to the state enterprise	built-in control preferably	built-in control range	outside audit Quality is high	outside audit Poor quality
ESG	0.012***	0.018***	0.015***	0.031	0.017*	0.014***
	(0.003)	(0.003)	(0.002)	(0.019)	(0.009)	(0.002)
Constant	8.442***	8.074***	7.819***	8.037***	7.886***	7.805***
	(0.145)	(0.172)	(0.045)	(0.660)	(0.189)	(0.046)
controlled variable	yes	yes	yes	yes	yes	yes
Cluster to enterprise	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
sample capacity	21,733	11,973	32,043	153	2,047	31,655
Adj R2	0.824	0.887	0.828	0.867	0.853	0.825

Note: *, ** and *** represent significance at the 10%,5% and 1% levels, respectively, with standard errors in parentheses.

6. Conclusions and Implications

6.1 Research Conclusions

This study examines the relationship between corporate ESG performance and resilience using A-share listed firms in Shanghai and Shenzhen (2011–2023). Through various tests, it concludes: ① ESG performance significantly enhances resilience, with higher ESG ratings linked to greater shock resistance, operational stability, and innovation. ② ESG boosts resilience via improved human capital, increased government subsidies, and enhanced green innovation. ③ The resilience-enhancing effect of ESG varies by ownership, internal control quality, and external audit quality, with stronger effects in state-owned firms, those with better internal controls, and weaker external audits. These

findings offer theoretical and practical insights into ESG's economic impacts and mechanisms[48].

6.2 Recommendations

Based on the above conclusions, in order to promote enterprises to improve ESG performance and enhance enterprise resilience, this study puts forward the following suggestions:

1. Enterprise level

Firms should embed ESG principles into strategies, setting long-term goals and increasing investment in environmental initiatives, social responsibility, and governance, such as energy-saving projects, employee welfare, and internal controls, to boost ESG performance and resilience, while prioritizing human capital by attracting talent through strong ESG practices, investing in training, and focusing on green innovation via increased R&D to develop competitive green technologies, and formulating tailored ESG strategies based on ownership, environment, and internal factors, with non-state-owned firms enhancing stakeholder transparency and those with weak internal controls improving systems to leverage ESG for resilience[49].

2. Government level

Policymakers should refine ESG-related regulations to guide firms in adopting ESG principles, offering incentives like tax breaks, subsidies, and low-interest loans to boost green innovation and social responsibility, thereby enhancing ESG performance and resilience, while establishing a standardized, scientific ESG rating system to ensure accurate and authoritative evaluations, coupled with stronger oversight of corporate ESG disclosures to guarantee truthful, complete information and increase market transparency[50].

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