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Research on the Impact of Climate Risk on the ESG Performance of Chinese Listed Companies

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Abstract: *In recent years, global climate change has led to frequent extreme weather events, and the impact of climate risks on corporate operations has become increasingly prominent. This paper takes Chinese A-share listed companies from 2009 to 2024 as samples and uses a double fixed-effect model to explore the impact mechanism of climate risks on corporate ESG performance. This paper expands the theoretical framework of non-financial risk transmission mechanisms, reveals the regulatory roles of internal and external paths and policy environments, provides a new perspective for understanding corporate climate response behaviors, and puts forward corresponding policy suggestions.*

Keywords: *Physical Risk; Transition Risk; ESG Performance; Managerial Myopia; Environmental Investment*

1. Introduction

The IPCC's Sixth Assessment Report (2023) warns that the climate crisis is already causing irreversible damage. In China, corporate activities are highly exposed to climate risks, categorized as physical risks—threatening assets and supply chains—and transition risks, which create hidden costs through policy and technology shifts. ESG performance has become a key measure of corporate sustainability. Studying how climate risks affect corporate ESG performance holds significant value. Theoretically, it addresses gaps in existing literature and supports the development of a localized framework. Practically, it guides corporate risk management and informs government climate policy.

2. Literature Review

2.1 The Connotation and Classification of Climate Risks: Physical Risks and Transformational Risks

Based on the Financial Stability Board's TCFD framework, this paper defines climate risk as the potential for substantial adverse impacts on ecosystems, socioeconomic systems, and corporate financial performance caused by climate change and societal responses. Climate risks are categorized into two types based on origin and mechanism. Physical Risks: Result from acute extreme weather events and chronic climate shifts, directly damaging corporate assets, supply chains, and market demand. They are destructive and often irreversible. Transition Risks: Arise from shifts in policy, technology, markets, and law during the low-carbon transition, posing financial and reputational challenges. These risks are policy-driven and strategic in nature.

2.2 The impact of climate risks on the ESG performance of enterprises is dual in nature

Climate risks pose both challenges and potential transformational forces to the ESG performance of enterprises. On one hand, climate risks inhibit the ESG performance of enterprises through financial and operational channels. Physical and transformational risks such as extreme weather and carbon pricing policies directly impact enterprise assets and supply chains, thereby increasing operational costs(Caldecott et al., 2021)[1].On the other hand, climate risks, as an external driving force, motivate enterprises to enhance their ESG levels(Yun, 2025)[2].

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2.3 Climate risks affect the sustainable development capabilities of enterprises through two channels

Research on how climate risks affect corporate sustainable development primarily focuses on two areas: One is the impact on the financial capabilities of enterprises. Climate transition risks significantly increase corporate financing costs and provisions for asset impairment, while reducing revenue growth and profit margins, thereby raising the probability of default(Chen Guojin, 2023)[3]; These risks also reduce corporate investment efficiency, an effect amplified by industry competition (Xu et al.,2024)[4].Conversely, some studies indicate that climate risks can stimulate increased long-term investment, particularly in green innovation(Griffin, 2020)[5].The second aspect is the impact on corporate credit risk. Climate risks significantly undermine corporate credibility in loan and bond issuance, increasing default probability and elevating credit risk(Bell and Van,2022)[6]; For large enterprises, greater climate exposure triggers short-term negative market reactions, adversely affecting stock prices by intensifying trading activity, raising investor attention, and reducing positive media coverage. This can lead to stock price collapse risks, even without proactive information disclosure (Wu et al., 2022)[7].

2.4 Influencing Factors and Economic Consequences of an Enterprise's ESG Performance

Corporate ESG performance is shaped by internal governance structures and external institutional pressures, ultimately translating into tangible economic value. Internally, factors like board composition and equity structure determine implementation capacity, while externally, regulatory frameworks and stakeholder expectations create compelling incentives for ESG adoption(BÉNABOU et al., 2010)[8].Economically, strong ESG performance yields competitive advantages through enhanced capital attraction, stimulated innovation(Qian, 2024)[9];and strengthened brand loyalty(Wu et al., 2023)[10].

Current research reveals two critical gaps: first, the absence of a systematic theoretical framework explaining how climate risks specifically affect ESG performance, with most studies focusing narrowly on financial or emission impacts; second, insufficient empirical evidence from China's unique institutional context. This study addresses these gaps by integrating stakeholder and dynamic capability theories to develop a comprehensive analytical framework. Using ESG ratings and corporate disclosures from Chinese listed companies, it provides empirical validation to advance this emerging research domain.

3. Empirical Research

3.1 Sample Selection and Data Sources

This study examines Chinese A-share listed companies from 2009 to 2024, using data from RESSET, CSMAR, and CNRDS databases. To measure climate risk exposure, this research adopts the textual analysis method of Du Jian et al. (2023)[11]. Drawing on existing research, this study adopts the following criteria to screen and process the samples: (1) Remove samples with abnormal data; (2) Exclude ST and financial industry (Securities Regulatory Commission 2012 version of industry classification); (3) Remove data with severe missing of key indicators; (4) Remove samples with missing variable data; (5) To eliminate the influence of extreme values on the research results, the study performs tail trimming at the 1% level before and after for continuous variables. Finally, 48,911 observations were determined.

3.2 Empirical Model and Variable Selection

This paper constructs the following baseline regression model:

$$\mathrm{ESG}_{i,t} = \beta_0 + \beta_1 \mathrm{CR}_{i,t} + \gamma \mathrm{Controls}_{i,t} + \sum_t \mathrm{Year} + \sum_i \mathrm{Firm} + \varepsilon_{i,t} \quad (1)$$

Among them, $\mathrm{ESG}_{i,t}$ represents the ESG performance score of enterprise i in year t; $\mathrm{Controls}_{i,t}$represents the control variables at the enterprise level; and also includes individual and time fixed effects; $\varepsilon_{i,t}$represents the random disturbance term. The variables selected in this paper are shown in Table 1:

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Table 1: Variable Definitions.

Variable Type	Variable Name	Metric
Dependent Variable	Social, Environmental and Governance Performance	HSBC ESG Rating
Independent Variable	Climatic Risk Index	The climate risk indicator was calculated as the ratio of the 98 identified climate-related keywords to the total word count in the annual reports.
Control Variables	Enterprise Size	In (total number of employees of the enterprise+1)
	Debt Ratio	Year-end Liabilities/Year-end Assets
	Return on Total Assets	Net Profit/Total Assets
	Enterprise Cash Flow Ratio	Cash flow generated from enterprise operating activities/Total Assets
	Executive Compensation Incentive	In (total annual compensation of management+1)
	First Largest Shareholder Shareholding Ratio	First largest shareholder's shareholding ratio

3.3 Baseline Regression Results and Analysis

Table 2 presents the baseline regression results examining the impact of climate transition risk on corporate ESG performance. Column (1) reports results without control variables but with firm and year fixed effects. The coefficient for climate risk is 1.891, significant at the 1% level, indicating that without controlling for other factors, a one-unit increase in climate risk corresponds to a 1.891-point improvement in ESG scores. This suggests that firms facing higher climate risks enhance their ESG performance in response to regulatory pressures and market scrutiny.

Table 2: Baseline Regression.

	(1)	(2)
VARIABLES	ESG	ESG
CR	1.891***	1.264***
	(4.81)	(3.35)
Lev		-5.142***
		(-17.31)
ROA		4.154***
		(7.56)
Cashflow		-1.829***
		(-4.70)
Top1		2.188***
		(4.18)
Size		1.149***
		(15.89)
Pay		0.437***
		(5.34)
Constant	73.392***	60.005***
	(665.56)	(49.94)
Observations	48,911	48,911
R-squared	0.029	0.068
Number of ID	5,325	5,325
Year Effects	YES	YES
Firm Effects	YES	YES
r2_a	0.0287	0.0674
F	121.4	119.9
Robust t-statistics in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

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3.4 Robustness Tests

To ensure the reliability of the baseline findings, this study conducts the following robustness tests, with results presented in Table 3. Column (1) introduces industry fixed effects to account for varying ESG practices across sectors. The climate risk (CR) coefficient remains significantly positive (1.329, $p<0.01$), confirming that the main results are not driven by time-invariant industry characteristics. Column (2) excludes observations from 2016 (Paris Agreement ratification) and 2020 ("dual carbon" goals announcement) to mitigate potential exogenous policy shocks[12].The CR coefficient remains statistically significant, demonstrating that the positive climate risk-ESG relationship is not driven by short-term policy impacts.

Table 3: Robustness Test.

	(1)	(2)
VARIABLES	ESG	ESG
	Add industry fixed effects	Exclude the years 2016 and 2020
CR	1.329***	1.109***
	(4.87)	(2.81)
Lev	-5.172***	-4.993***
	(-24.38)	(-16.16)
ROA	4.078***	3.631***
	(8.75)	(6.21)
Cashflow	-1.721***	-1.662***
	(-4.97)	(-4.04)
Top1	2.023***	2.140***
	(5.81)	(3.95)
Size	1.164***	1.161***
	(23.65)	(15.38)
Pay	0.413***	0.459***
	(6.82)	(5.35)
Constant	59.114***	59.607***
	(64.43)	(47.19)
Observations	48,781	42,656
R-squared	0.489	0.071
Firm Effects	YES	YES
Year Effects	YES	YES
Industry Effects	YES	NO
r2_a	0.426	0.0703
F	209.6	124.7
Robust t-statistics in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

3.5 Mediation Effect Analysis

To uncover the internal mechanisms through which climate risk influences corporate ESG performance, this study examines two mediating pathways: managerial myopia and environmental investment. Managerial myopia (SI) is measured following Wang Haiming et al.(2013)[13] as the ratio of short-term investments to total assets. Environmental investment (GI) is constructed based on Zhang Qi et al.(2019)[14]by aggregating project expenditures related to pollution prevention, ecological management, and green production, scaled by total assets. Data are sourced from the CSMAR database.

As shown in Column (1) of Table 4 climate risk (CR) significantly reduces managerial short-termism (SI) with a coefficient of -0.027 ($p<0.01$). This indicates that climate pressure compels managers to adopt longer-term strategic perspectives. The alleviation of myopia facilitates ESG-oriented decisions by promoting future-focused planning and resilience building[15].

Column (2) demonstrates that climate risk significantly increases environmental investment (GI) ($p<0.01$). Such investments directly enhance environmental capabilities and assets, strengthening the foundation for corporate environmental performance and contributing to higher ESG scores[16].

In summary, climate risk systematically improves ESG performance through a dual mechanism: cognitively, it counteracts managerial short-termism, enabling long-term strategic alignment;

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operationally, it directs capital toward green investments that build sustainable competitive advantages.

Table 4: Mediation Effect Analysis.

	(1)	(2)
VARIABLES	SI	EI
CR	-0.027***	2.008***
Individual Controls	YES	YES
Constant	0.058	-0.755*
	(1.16)	(-1.65)
Observations	46,582	48,911
R-squared	0.007	0.018
Number of ID	5,285	5,325
Year Effect	YES	YES
Industry Effects	YES	YES
r2_a	0.00643	0.0178
F	29.10	4.353
Robust t-statistics in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

3.6 Heterogeneity Analysis

The baseline effect of climate risk on ESG performance varies significantly across regions and industries, as shown in Table 5.

Eastern China: Displays the strongest positive effect, attributable to stringent environmental regulations and mature green finance systems. Central China: Shows an insignificant negative coefficient, reflecting transitional institutional environments where climate incentives remain underdeveloped. Western China: Presents an insignificant positive relationship, suggesting growth priorities and resource constraints limit systematic ESG transformation.

Low-pollution Industries: Exhibit significant ESG improvement, leveraging climate risks as market opportunities. High-pollution Industries: Demonstrate an insignificant positive relationship, indicating structural constraints like technological lock-in and high compliance costs create "strategic inertia." These findings confirm that climate risk's ESG impact is context-dependent, highlighting the need for differentiated climate governance and ESG guidance policies.

Table 5: Heterogeneity Analysis.

	(1)	(2)	(3)	(5)	(6)
VARIABLES	East	Middle	West	LowPollution	HighPollution
CR	1.863***	-1.333	1.302	1.619***	0.787
	(3.99)	(-1.51)	(1.60)	(3.57)	(1.21)
Individual Controls	YES	YES	YES	YES	YES
Constant	60.858***	58.412***	57.055***	59.667***	59.908***
	(40.05)	(21.56)	(19.03)	(43.20)	(23.00)
Observations	35,004	7,644	6,019	38,188	10,723
R-squared	0.064	0.071	0.091	0.071	0.082
Number of ID	3,958	808	610	4,400	1,207
Year Effects	YES	YES	YES	YES	YES
Firm Effects	YES	YES	YES	YES	YES
r2_a	0.0632	0.0683	0.0877	0.0703	0.0802
F	81.22	21.36	22.01	88.70	39.19

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4. Conclusion and Policy Recommendations

4.1 Research Findings

The main conclusions of this study are as follows: First, climate risk has a significant positive impact on the ESG performance of enterprises; Second, climate risk promotes the ESG performance of

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enterprises by increasing the attention of analysts and enhancing environmental protection investment; Third, it is most pronounced in developed eastern regions with stringent regulations and mature green finance systems, and more responsive in low-pollution industries where firms leverage ESG for brand enhancement and green financing.

4.2 Policy Recommendations

Based on the research findings and China's national context, this study proposes the following policy recommendations during the critical "dual carbon" transition period:First, the government and regulatory authorities should implement differentiated climate risk governance, such as establishing mandatory environmental information disclosure standards and a transition finance framework, and opening green channels for enterprises that demonstrate a credible transformation path;Second, financial and market institutions should strengthen market-based incentive mechanisms, enhance the intermediary role of a unified ESG data platform, and provide tax incentives for green technology investment;Third, it is necessary to enhance the enterprise's ability to respond to risks.On one hand, enterprises can promote the deep integration of digitalization and green low-carbon transformation by actively applying carbon management platforms and cultivating green digital services. On the other hand, the government or industry associations can establish special support funds for small and medium-sized enterprises with limited resources.

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