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How Does Government Attention to Climate Risks Drive Corporate Green Investment? A Stakeholder Theory-Based Empirical Analysis

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Abstract

Against the backdrop of escalating global climate risks, whether and how government attention to climate risks affects corporate green investment is a key issue to address the "macro–micro" transmission obstruction in green economic transformation. Based on stakeholder theory, combining text analysis and panel data regression methods, this paper systematically examines the impact effect, transmission mechanism, and economic consequences of government attention to climate risks on corporate green investment, using Chinese A-share listed companies from 2010 to 2023 as research samples. The findings are as follows: (1) Government attention to climate risks significantly and positively promotes corporate green investment, and this conclusion remains valid after multiple robustness tests; (2) government attention to climate risks indirectly drives enterprises to increase green investment by strengthening environmental regulation constraints and encouraging corporate green innovation; (3) the promotion effect is more significant in enterprises in central China, manufacturing enterprises, and heavily polluting enterprises; (4) there is a U-shaped relationship between corporate green investment and corporate value. Government attention to climate risks significantly strengthens this U-shaped correlation by lowering the value return threshold of green investment and amplifying the marginal returns after crossing the threshold.

Keywords: government attention to climate risks; corporate green investment; stakeholder theory; mechanism analysis; economic consequences

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1. Introduction

Against the backdrop of drastic changes in the global climate system, climate risks have transformed from long-term potential threats into normalized high-intensity shocks, profoundly reshaping the operational environment and strategic layout logic of enterprises worldwide [1]. Currently, the global net-zero transition is the core consensus of climate governance, with continuous deepening of international cooperation in climate action. Climate policy signals are constantly escalating, and policy tools have gradually evolved from single incentives to a full-chain framework encompassing carbon pricing, green finance, and technical standards, forming a systematic guiding synergy to promote enterprises' low-carbon transformation [2,3]. However, there remains a significant disconnect between macro climate governance orientations and micro corporate practices: On the one hand, governments around the world are paying increasing attention to climate

risks, with continuous deepening of relevant policy arrangements, which have become important institutional signals guiding enterprises' green transformation [4]; on the other hand, corporate green investment shows an obvious structural differentiation trend. Enterprises in high-energy-consuming and high-emission sectors have relatively lagging transformation willingness, and even those with transformation motivation face significant resource constraints and financing difficulties. Relevant data indicate that the global annual climate financing demand is expected to increase to 9 trillion US dollars by 2030, while the current annual investment in climate mitigation is only 1.2 trillion US dollars. The insufficient supply of green investment has become a key bottleneck restricting the global low-carbon transition process [5]. This practical deviation determines that the transmission path, inherent operational mechanism, and key nodes of government attention to climate risks to corporate green investment decisions constitute a core issue urgently needing clarification in the fields of global climate governance and corporate sustainable development. Its transmission efficiency and mechanism integrity directly affect the realization process of global net-zero transition goals, and are also related to the cultivation of enterprises' long-term competitiveness under the impact of climate risks.

The existing literature has formed two types of explanations for the driving factors of corporate green investment: One is mandatory policy tools such as environmental regulation and carbon pricing, which form a reverse driving effect through compliance cost pressure and market incentive mechanisms [6,7]; the other is spontaneous market forces such as market demand and investors' ESG preferences, which generate traction through value-oriented guidance and capital allocation adjustments [8,9]. However, existing research still has obvious limitations: First, the research perspective falls into the duality of hard constraints and self-driving, ignoring the unique value of guiding soft signals, and failing to take government attention to climate risks as an independent driving factor to systematically analyze its inherent mechanism of influencing investment decisions by shaping corporate expectations; second, there is a break in the research chain of transmission mechanisms, failing to effectively decompose the specific path of transforming "soft signals" into "hard investment", and the inherent operational mechanism is still in a black box state. Stakeholder theory points out that, as a core stakeholder of enterprises, the government's policy attention not only conveys legitimacy requirements but also releases resource support signals [10]. Enterprises need to adjust their strategies to adapt to the external environment, thereby obtaining necessary legitimacy recognition and resource support [11]. However, existing research has not clarified the specific logic of transforming soft signals into green hard investment when applying this theory, which is the core research direction of this paper.

Based on this, this paper takes Chinese A-share listed companies from 2010 to 2023 as research samples and answers four progressive questions: first, whether government attention to climate risks directly and positively affects corporate green investment; second, whether government environmental regulation and corporate green innovation constitute indirect transmission paths between the two; third, whether this impact has heterogeneity at the regional, industrial, and enterprise type levels; and fourth, whether government attention to climate risks can ultimately enhance corporate value by promoting corporate green investment, forming a complete closed loop of "signal—investment—value". The marginal contributions of this paper are mainly reflected in two aspects: Theoretically, it constructs a complete analytical framework of "direct impact—operational mechanism—heterogeneous characteristics—economic consequences" clearly reveals the inherent logic of transforming government attention to climate risks into corporate green investment, and expands the application scenario of stakeholder theory in the field of climate governance; practically, it provides empirical support for the government to optimize climate-related

policy design and enterprises to formulate green transformation strategies, helping to promote the coordinated development of enterprise transformation and high-quality economic development under the dual carbon goals.

2. Theoretical Analysis and Research Hypotheses

2.1. Legitimacy Acquisition

According to stakeholder theory, as a mandatory stakeholder with core regulatory power and resource allocation power, the government's attention to specific issues conveys strong institutional signals and legitimacy pressure to enterprises [12]. When the government attaches great importance to climate risks, it essentially establishes "fulfillment of climate responsibilities" as a new institutional logic that enterprises must follow. In this context, to obtain and maintain their institutional legitimacy, that is, the degree to which their behaviors are recognized by mainstream social values, norms, and authoritative institutions, enterprises will actively or passively adjust their strategic behaviors [13]. Enterprises that fail to effectively respond to the government's climate demands will face multiple legitimacy risks. First, regulatory legitimacy risks may lead to stricter environmental inspections, administrative penalties, or market access restrictions; second, moral legitimacy risks may result in damage to public reputation and brand value; and third, cognitive legitimacy risks may lead to the market labeling them as "backward" or "irresponsible", thereby causing them to lose policy trust and competitive advantages. Therefore, to avoid the above risks and obtain policy dividends, the most direct and effective strategic response for enterprises is to conduct green investment, proving their compliance willingness and sense of responsibility to the government and other stakeholders through visible actions [14]. This response is not only a passive adaptation but also an active strategic choice to establish a favorable position in the new institutional environment.

Based on this, this paper proposes the following hypothesis:

H1: *Government attention to climate risks has a significant positive promoting effect on corporate green investment.*

2.2. Transmission Hardening

As a core stakeholder, if the government's attention to climate risks only remains at the macro signal level, its effectiveness will be significantly weakened by enterprises' selective responses. Thus, its influence needs to achieve transmission hardening via environmental regulation as the core carrier: converting abstract policy demands into specific, enforceable rules and incentives to reconstruct the "cost–benefit" structure of corporate investment [15].

First, at the government–enterprise bilateral level, environmental regulation directly shapes firms' investment decisions through a combination of restrictive and incentive tools [16]. Restrictive regulation internalizes the climate external costs of high-carbon investment, raising its compliance costs and operational risks while compressing profit margins; incentive regulation reduces the marginal costs and uncertainties of green investment, boosting its expected returns. This dual adjustment (raising high-carbon costs + increasing green returns) signals to enterprises that green investment has greater comparative advantages, driving proactive strategic adjustments [17].

Second, environmental regulation activates and coordinates other stakeholders to form a multi-agent collaborative governance network. In finance, banks and investment funds integrate environmental regulation standards into credit/investment evaluations, applying punitive finance to high-carbon firms and preferential finance to green firms—forming an effective green finance screening mechanism [18]. In supply chains, core enterprises (e.g., large manufacturers/retailers) screen suppliers by environmental compliance, forcing

upstream/downstream firms to green-transform via green supply chain management [19]. These stakeholders essentially convert government regulatory pressure into market-based constraints, squeezing the space for non-green investment. Ultimately, firms systematically tilt resource allocation toward green investment under the dual forces of "government supervision + market constraints".

Accordingly, this paper proposes the following hypothesis:

H2: *Government attention to climate risks promotes corporate green investment by strengthening environmental regulation.*

2.3. Strategic Adaptation

Unlike the hard constraints of external regulation, government attention to climate risks can guide enterprises to achieve strategic adaptation through green innovation, realize value co-creation and resource aggregation while responding actively to policy demands, and thereby feed back into green investment [20]. This transmission mechanism operates through two specific paths.

First, government attention to climate risks anchors the direction of corporate green innovation and mitigates uncertainties by releasing clear policy signals, thus laying a solid foundation for green investment. Essentially, government focus on climate risks conveys dual signals to the market: "key areas of policy support" and "highlands of commercial value" [21]. This highly directional and stable signal not only delineates core areas for enterprises' green technology selection (e.g., carbon emission reduction technologies, clean energy development, and other fields aligned with the dual carbon goals) to avoid innovation trials caused by vague technical directions and reduce R&D resource misallocation costs, but also clarifies the income expectations of green innovation through supporting policy tools such as subsidies, tax reductions, and access convenience. Guided by this signal, enterprises investing innovation resources in policy-encouraged high-value areas can not only meet the government's climate governance demands to obtain policy dividends but also pre-layout the green market to seize competitive advantages. The transmission logic of "government attention to climate risks → policy signal release → innovation direction locking → risk cost reduction" clarifies the input–output expectations of green innovation, which not only drives enterprises to increase green R&D investment but also eliminates their uncertainty about green investment through mature technological achievements and clear commercial prospects, providing dual guarantees of technical feasibility and commercial rationality for green investment.

Second, the policy orientation derived from government attention to climate risks positions green innovation as a core hub for enterprises to leverage diverse external resources, promoting the large-scale expansion of green investment through the resource aggregation effect. Continuous government attention to climate risks forms a two-way "policy–market" incentive mechanism: For the government, corporate green innovation is a microcosmic reflection of the effectiveness of climate governance policies, and the alignment between policy goals and corporate practices enables enterprises to continuously obtain policy resources such as special support funds and green credit interest subsidies [22]; for investors, government attention triggers the market's revaluation of green assets, making green innovation capability a core indicator for evaluating enterprises' ESG performance and long-term growth potential, while policy endorsement further reduces the risk premium of green investment, prompting green institutional investors and other capitals to actively inject funds, thereby easing financing constraints and reducing capital costs [23]; for consumers, the upgrading of green consumption concepts under policy guidance makes green innovative products more likely to meet market preferences, helping enterprises establish brand loyalty and obtain green premiums [24]. The continuous inflow of these policy,

capital, and market resources not only provides financial support for green innovation to move from the laboratory to industrialization, but also spreads green investment costs through economies of scale, promoting green investment from the R&D pilot stage to large-scale commercial application, and ultimately forming a virtuous cycle of "government attention to climate risks → prominent value of green innovation → aggregation of diverse resources → expansion of green investment".

Accordingly, this paper proposes the following hypothesis:

H3: *Government attention to climate risks promotes corporate green investment by encouraging corporate green innovation.*

In summary, the theoretical framework of this paper is shown in Figure 1.

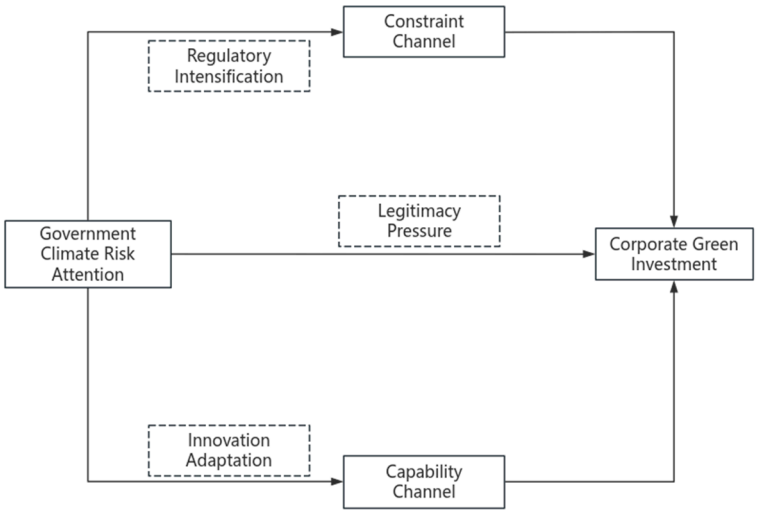


Figure 1. Theoretical framework.

3. Research Design

3.1. Identification Strategy

(1) Benchmark Regression Model

To test the direct impact of government attention to climate risks on corporate green investment, this paper constructs the following benchmark regression model:

$$Gi_{i,j,t} = \alpha_0 + \beta Cr_{j,t} + \delta City_{j,t} + \varphi Bus_{i,j,t} + \mu_t + \gamma_p + \varepsilon_{i,j,t} \quad (1)$$

where $Gi_{i,j,t}$ represents the green investment level of enterprise i in city j in year t; $Cr_{j,t}$ represents the government attention to climate risks of city j in year t; $City_{j,t}$ is the city-level control variable; $Bus_{i,j,t}$ is the firm-level control variable; μ_t and γ_p represent the year and industry fixed effects, respectively; α_0 is the intercept term; β is the regression coefficient of the explanatory variable; δ and φ are the regression coefficients of the city-level and firm-level control variables, respectively; and $\varepsilon_{i,j,t}$ is the random error term, which satisfies independent and identical distribution.

(2) Mechanism Identification

To test the mechanism effects of government environmental regulation and corporate green innovation, this paper constructs the following models:

$$Ge_{i,t} = \beta_0 + \beta_1 Cr_{j,t} + \beta_2 City_{j,t} + \beta_3 Bus_{i,j,t} + \mu_t + \gamma_p + \varepsilon_{i,j,t} \quad (2)$$

$$Gt_{i,j,t} = \beta_0 + \beta_1 Cr_{j,t} + \beta_2 City_{j,t} + \beta_3 Bus_{i,j,t} + \mu_t + \gamma_p + \varepsilon_{i,j,t} \quad (3)$$

where Ge and Gt are government environmental regulation and corporate green innovation, respectively; β_0 is the intercept term; β_1, β_2, and β_3 are regression coefficients; and the meanings of other variables are the same as those in Equation (1).

(3) Economic Consequence Identification

To identify the economic consequences of corporate green investment, this paper constructs the following models:

$$Ev_{i,j,t} = \beta_0 + \beta_1 Gi_{i,j,t} + \beta_2 Gi_{i,j,t}2 + \beta_3 City_{j,t} + \beta_4 Bus_{i,j,t} + \mu_t + \gamma_p + \varepsilon_{i,j,t} \quad (4)$$

$$Ev_{i,j,t} = \beta_0 + \beta_1 Gi_{i,j,t} + \beta_2 Gi_{i,j,t}2 + \beta_3 Cr_{j,t} + \beta_4 Gi_{i,j,t} \times Cr_{j,t} + \beta_5 Gi_{i,j,t}2 \times Cr_{j,t} + \beta_6 City_{j,t} + \beta_7 Bus_{i,j,t} + \mu_t + \gamma_p + \varepsilon_{i,j,t} \quad (5)$$

3.2. Variable Definition

(1) Dependent Variable: Corporate green investment (Gi). Following the measurement logic of existing studies [25,26], this paper identifies and aggregates the capitalized and expensed expenditures directly related to green investment by combing through the detailed items in the notes to the financial statements of listed companies, so as to measure the actual scale of corporate green investment. Specifically, capitalized expenditures are derived from environment-related items under the detail of "Construction in Progress", including capitalized investments in wastewater and waste gas treatment facilities, energy-saving/water-saving/electricity-saving equipment, desulfurization/denitrification/nitrogen removal/dust removal devices, waste disposal systems, waste heat recovery and utilization facilities, exhaust gas treatment equipment, etc. Expensed expenditures are obtained from independent environmental protection items in the detail of "Administrative Expenses", specifically covering sewage charges, environmental protection fees, vegetation restoration fees, etc. Given that this paper focuses on the absolute scale characteristics of corporate green investment, the core proxy variable (denoted as Gi) is measured by the natural logarithm of the total corporate green investment plus 1 (the "plus 1" operation is intended to avoid the interference of zero values in logarithmic transformation). To enhance the robustness of the research conclusions, this paper further constructs two relative scale indicators as alternative proxy variables for green investment to conduct supplementary tests: (1) the ratio of total corporate green investment to end-of-period total assets; and (2) the ratio of total corporate green investment to current operating revenue.

(2) Core Explanatory Variable: Government attention to climate risks (Cr). Referring to the text analysis method of relevant studies [27] for quantification, keywords are selected from two themes: physical climate risks (including high temperature, heavy rain, floods, droughts, extreme weather, etc.) and transition climate risks (including low carbon, clean energy, carbon peaking, carbon neutrality, carbon trading, etc.). The frequency of these words in the government work report of a city in a certain year is counted and summed up. Finally, the ratio of the summed keyword frequency to the total number of words in the report is used to measure the government's attention to climate risks.

(3) Control Variables: Referring to the relevant literature [28], this paper selects the following control variables: (1) City-level control variables: economic development level (Ed), expressed by the natural logarithm of per capita regional GDP; and advanced industrial structure (Ig), expressed by the ratio of the added value of the tertiary industry to the added value of the secondary industry. (2) Firm-level control variables:

ownership nature (Soe), 1 for state-owned holding enterprises and 0 for others; firm size (Size), expressed by the natural logarithm of annual total assets; asset–liability ratio (Lev), expressed by the ratio of total liabilities at the end of the year to total assets at the end of the year; return on assets (Roa), expressed by the ratio of net profit to total assets; board size (Board), expressed by the natural logarithm of the number of directors; financing constraint degree (Sa), expressed by the Sa index, where a smaller index indicates more severe financing constraints; and firm age (Firmage), expressed by the natural logarithm of the difference between the year of establishment and the current year.

(4) Mechanism Variables: Government environmental regulation (Ge). Referring to relevant studies [29], the intensity of environmental regulation is measured by the proportion of the number of words in sentences containing "environmental protection" in each city's government work report to the total number of words in the entire government work report. Corporate green innovation (Gt). Referring to relevant studies [30], the number of green utility models independently applied by enterprises in the current year plus one and taking the natural logarithm is used to represent corporate green innovation.

3.3. Data Source

Chinese A-share listed companies from 2010 to 2023 are selected as the initial sample, which is processed as follows: (1) excluding listed companies in the financial industry; (2) excluding ST, *ST, and delisted companies; (3) excluding samples with missing key variables; and (4) Winsorizing all continuous variables at the 1% level. The data are from CSMAR database, Wind database, City Statistical Yearbook, government work reports, etc.; the text data of government attention to climate risks are obtained from local government work reports and environmental policy documents through Python 3.13.1 crawler, and word frequency analysis is performed. The descriptive statistics of variables are shown in Table 1:

Table 1. Descriptive statistics of variables.

Variable Name	Variable	Sample	Mean	Std. Dev.	Min	Max
Dependent Variable	Gi	37,412	4.672	7.388	0.000	24.762
Core Explanatory Variable	Cr	37,412	0.184	0.086	0.047	0.436
Control Variables	Ed	37,412	11.817	0.760	9.948	13.156
	Ig	37,412	1.747	1.145	0.463	5.691
	Soe	36,631	0.360	0.480	0.000	1.000
	Size	37,412	22.209	1.318	19.875	26.352
	Lev	37,412	0.411	0.207	0.049	0.883
	Roa	37,412	0.038	0.060	−0.225	0.193
	Board	37,409	2.116	0.199	1.609	2.639
	Sa	37,412	−3.837	0.270	−4.528	−3.126
	Firmage	37,412	2.938	0.336	1.946	3.611
Mechanism Variables	Ge	37,412	0.939	0.221	0.502	1.656
	Gt	37,412	0.201	0.531	0.000	2.708

4. Empirical Results

4.1. Benchmark Regression

To examine the impact of government attention to climate risks on corporate green investment, this paper conducts an empirical analysis using the benchmark regression model (1), with the results presented in Table 2. Column (1) includes only city-level control variables, while column (2) further incorporates firm-level control variables to enhance

model robustness. The regression results indicate that, regardless of whether all control variables are included, the regression coefficient of government attention to climate risks (Cr) is statistically significantly positive. This outcome supports Research Hypothesis H1, namely, that an increase in government attention to climate risks significantly promotes corporate green investment.

Table 2. Benchmark regression results.

Variable	(1) Only City-Level Controls	(2) All Controls
Cr	1.769 **	1.794 **
	(0.85)	(0.77)
Ed	−0.840 ***	−0.778 ***
	(0.19)	(0.13)
Ig	0.030	−0.089
	(0.14)	(0.12)
Soe		0.918 ***
		(0.21)
Size		1.055 ***
		(0.09)
Lev		0.943 **
		(0.47)
Roa		−0.951
		(0.96)
Board		0.188
		(0.50)
Sa		−2.165 ***
		(0.62)
Firmage		−1.487 ***
		(0.49)
Industry Fixed	Yes	Yes
Year Fixed	Yes	Yes
N	37,410	36,626
R^2	0.174	0.212

Note: Standard errors clustered at the industry level are in parentheses below the estimated coefficients. ** and *** indicate significance at the 5% and 1% levels, respectively.

Further interpreting from an economic significance perspective, taking the estimation results in column (2) as an example, based on marginal effect analysis: When government attention to climate risks (Cr) increases by one standard deviation (0.086), the original scale of corporate green investment rises by an average of approximately 16.8%; converted using the sample mean, this change corresponds to an average increase of about 172,000 yuan in the RMB scale of corporate green investment. This indicates that the impact of government attention to climate risks on corporate green investment not only possesses statistical significance but also exhibits considerable economic significance.

4.2. Robustness Tests

To verify the robustness of the benchmark regression conclusions, this paper conducts tests through various strategies, and the results are shown in Table 3: (1) Changing the standard error clustering method. Re-regress by clustering standard errors at the industry–year level, and the result is significantly positive; (2) replacing the measurement method of the core variable 1. Use the ratio of total corporate green investment to total assets to characterize corporate green investment, and re-regress; the result is still significant. (3) Replacing the measurement method of the core variable 2. Use the ratio of total corporate green investment to operating income to characterize corporate green investment, and re-regress; the result is significantly positive. (4) Adding the interaction term of year and industry fixed effects. To exclude factors that change over time at the industry level,

add the interaction term of year and industry fixed effects to the benchmark model for regression, and the result is still significantly positive. (5) Instrumental variable method. This paper selects urban topographic relief data as the instrumental variable for government attention to climate risks, and expands it from cross-sectional data to panel data through interaction with year dummy variables. Its rationality lies in the following: Correlation. Areas with greater topographic relief have more unstable climate systems and a higher probability of extreme climate events (such as landslides, local droughts, etc.), resulting in higher climate risk exposure. Therefore, the government will pay more attention to climate risks, so topographic relief is significantly positively correlated with government attention to climate risks; Exogeneity. Topographic relief is an inherent natural geographical feature, which is not affected by economic outcomes such as corporate green investment and corporate value, and is irrelevant to the disturbance term of the dependent variable, meeting the exogeneity requirement. The two-stage least squares regression results show that the coefficient of Cr is 0.353, which is significantly positive at the 1% level. In addition, the *p*-value of the Anderson LM statistic is 0.000, rejecting the hypothesis of insufficient identification of instrumental variables, and the Wald F statistic of 828.413 indicates that the instrumental variable is not a weak instrument. (6) PSM: To mitigate potential sample selection bias between the core explanatory variable and the explained variable, this paper further employs the Propensity Score Matching (PSM) method for robustness testing. All control variables are included as covariates, and a logit model is constructed with the grouping result of the core explanatory variable (government attention to climate risks) as the dependent variable to estimate the propensity scores of the samples. A 1:3 nearest neighbor matching strategy with replacement is then implemented. The results of the balance test are presented in Table 4 and Figure 2. After matching, the absolute values of the standardized bias of all covariates between the treatment group and the control group are reduced to less than 10%, and the *t*-test results show that the inter-group differences in most covariates are no longer significant. This fully demonstrates that the matching operation effectively eliminates the systematic differences in covariates between the two groups of samples, and the matched samples have good comparability. Re-running the benchmark regression based on the matched samples, the results indicate that the sign and significance level of the coefficient of the core explanatory variable (government attention to climate risks) are consistent with those of the benchmark regression, and there is no substantial change in the coefficient value. Thus, it is confirmed that the conclusion from the benchmark regression—government attention to climate risks has a significant positive impact on corporate green investment—still holds after mitigating sample selection bias.

Table 3. Robustness test results.

Variable	(1) Change Clustering	(2) Replace Measure 1	(3) Replace Measure 2	(4) Year–Industry Fixed	(5) IV Method		(6) PSM
					First Stage	Second Stage	
Cr	1.794 **	0.312 **	1.435 **	1.592 **	0.001 ***	0.353 ***	0.261 **
	(0.72)	(0.16)	(0.71)	(0.78)	(0.00)	(0.04)	(0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry Fixed	No	No	No	Yes	No	No	No
LM Statistic	-	-	-	-	634.935 ***		-
Wald F Statistic	-	-	-	-	828.413		-
N	36,626	36,628	36,624	36,558	36,560		32,103
R2	0.212	0.071	0.057	0.208	0.212	0.367	0.216

Note: Standard errors clustered at the industry–year level are in parentheses below the estimated coefficients in column (1). ** and *** indicate significance at the 5% and 1% levels.

Table 4. PSM validity test.

Variable	Matched or Not	Mean Value		*T*-Test
		Treatment Group	Control Group	
Ed	Unmatched	11.872	11.768	13.07 ***
	Matched	11.872	11.893	−2.51 **
Ig	Unmatched	1.619	1.838	−18.29 ***
	Matched	1.618	1.647	−2.53 **
Soe	Unmatched	0.345	0.372	−5.43 ***
	Matched	0.345	0.340	0.82
Size	Unmatched	22.181	22.222	−2.96 ***
	Matched	22.18	22.191	−0.74
Lev	Unmatched	0.411	0.411	0.27
	Matched	0.411	0.413	−0.75
Roa	Unmatched	0.0365	0.039	−4.85 ***
	Matched	0.0365	0.036	0.47
Board	Unmatched	2.113	2.118	−2.36 **
	Matched	2.113	2.112	0.36
Sa	Unmatched	−3.846	−3.829	−6.20 ***
	Matched	−3.847	−3.849	0.70
Firmage	Unmatched	2.944	2.931	3.76 ***
	Matched	2.944	2.948	−0.96

Note: ** and *** indicate significance at the 5% and 1% levels.

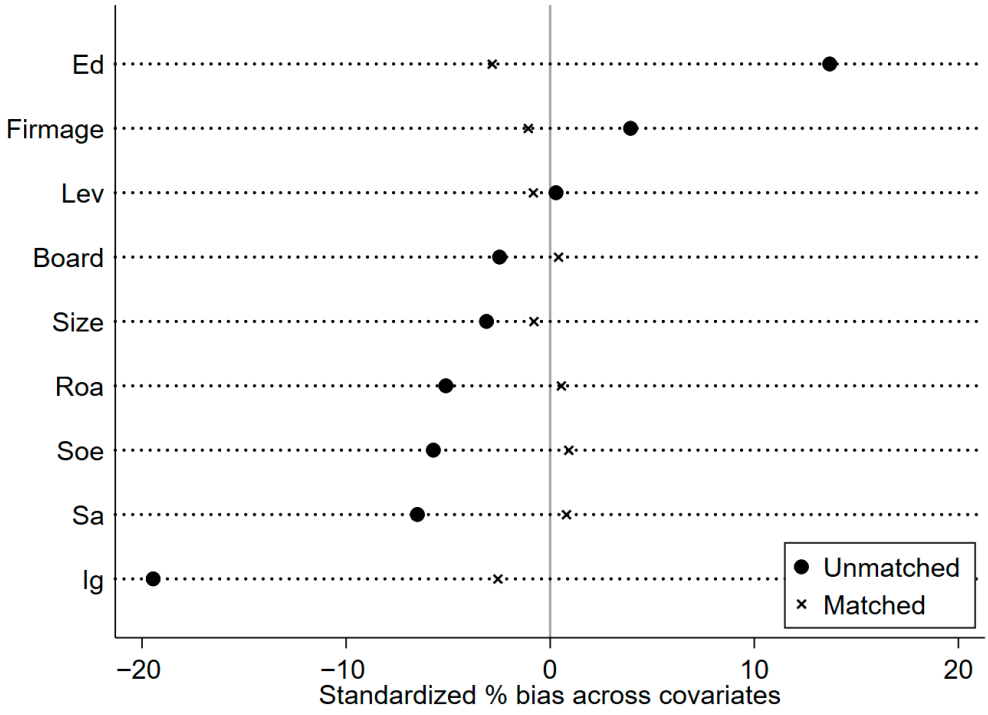


Figure 2. Balance test.

In summary, under various robustness test strategies, the positive impact of government attention to climate risks on corporate green investment is always significant, and the benchmark regression conclusion has strong robustness.

4.3. Mechanism Tests

The previous section elaborated on the mechanism path of the impact of government attention to climate risks on corporate green investment. To further verify whether the two mechanisms of government environmental regulation and corporate green innovation exist, referring to relevant studies [31,32], models (2) and (3) are constructed, and the dependent variable is replaced with the proxy variables of government environmental regulation and corporate green innovation for re-testing.

The results in Table 5 show that, when government environmental regulation is taken as the dependent variable in column (1), the estimated coefficient of government attention to climate risks is 0.616, which is significantly positive at the 1% significance level. This indicates that the government's attention to climate risks will strengthen the intensity of environmental regulation and then increase corporate green investment. The underlying logic is that, in regions with higher attention to climate risks, the government is more inclined to introduce strict environmental protection standards, pollution control policies, etc., and guide or restrict corporate behaviors by improving the level of environmental regulation, thereby promoting corporate green investment; when corporate green innovation is taken as the dependent variable in column (2), the estimated coefficient of government attention to climate risks is 0.145, which is significantly positive at the 5% significance level. It indicates that government attention to climate risks can encourage corporate green innovation activities and then promote corporate green investment. Government attention to climate risks points out the direction and aggregates resources for corporate green innovation. On the one hand, the climate field it focuses on is a policy support and commercial highland. Enterprises innovate accordingly to obtain policy dividends and seize market opportunities, eliminating the uncertainty concerns about green investment; on the other hand, green innovation can meet the needs of the government (proving policy effectiveness), investors (optimistic about ESG and growth potential), and consumers (consistent with green preferences), attract various resources, and promote green investment from pilot to large-scale commercialization, forming a virtuous cycle of "government attention → green innovation → resource aggregation → investment expansion".

Table 5. Mechanism test results.

Variable	(1) Government Environmental Regulation	(2) Corporate Green Innovation
Cr	0.616 ***	0.145 **
	(0.22)	(0.06)
Controls	Yes	Yes
Industry Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
N	36,628	36,628
R^2	0.132	0.160

Note: ** and *** indicate significance at the 5% and 1% levels.

4.4. Heterogeneity Analysis

To further clarify the differentiated characteristics and action boundaries of the impact of government attention to climate risks on corporate green investment, this paper systematically conducts heterogeneity tests from three dimensions: regional distribution, corporate pollution attributes, and industry type (the results are shown in Table 6). The specific analysis and interpretation are as follows:

(1) Regional Heterogeneity (columns 1–3): The impact presents a gradient differentiation pattern of "weak in the east—strong in the central—secondary in the west". The

regression coefficient of government attention to climate risks in the eastern region is not significant, which is closely related to the development characteristic of the region's relatively mature marketization process. The driving forces for corporate green transformation in the eastern region have shown a diversified evolutionary trend, and non-policy-driven factors such as market competition pressure and consumers' green preferences form a synergistic driving pattern, which significantly weakens the marginal incentive effect of government attention to climate risks on corporate green investment. The regression coefficient in the central region is 3.901, significant at the 5% significance level, with the most prominent driving effect; as the core bearing region for industrial structure upgrading, central enterprises are more sensitive to policy signals. The policy expectations released by government attention to climate risks have a significant leverage effect on capital flow, which can effectively guide the agglomeration of social capital in the field of green investment. The regression coefficient in the western region is positive but numerically weaker than that in the central region. Restricted by practical constraints such as a weak economic and technological foundation and an imperfect industrial supporting system, the transmission efficiency of policy signals to corporate green investment decisions is significantly restricted, and the room for releasing policy effects is relatively limited.

(2) Heterogeneity of Pollution Attributes (columns 4–5): The driving effect presents distinct "targeted" characteristics. The regression coefficient of heavily polluting industries is 4.414, significant at the 5% significance level, which is highly consistent with the policy regulatory positioning of such industries. As the core regulatory objects of climate risk management and environmental protection policies, heavily polluting enterprises face a higher level of climate risk exposure and environmental compliance pressure. The climate risk attention signals released by the government are more likely to be transformed into strong policy regulatory expectations and market incentive orientations, thereby forcing enterprises to increase green investment intensity. The regression coefficient of non-heavily polluting industries is not significant. The reason is that such industries have inherently low inherent correlation with climate risks, and enterprises have weaker perceptual sensitivity to policy signals related to government attention to climate risks, making it difficult for policies to form an effective green investment driving mechanism.

(3) Heterogeneity of Industry Types (columns 6–7): The promoting effect of government attention to climate risks is mainly concentrated in the real economy sector. The regression coefficient of the manufacturing industry is 2.384, significant at the 5% significance level; as the core bearing subject of resource consumption and environmental impact, the production and operation links of the manufacturing industry are strongly bound to the demand for green transformation. The government can effectively embed climate risk considerations into the enterprise's production decision-making process through targeted policy tools such as green supply chain management and industrial energy efficiency standard setting, thereby promoting the substantive implementation of green investment. The regression coefficient of the non-manufacturing industry fails the statistical significance test. On the one hand, it is due to its relatively low overall carbon emission intensity and resource dependence, resulting in less direct impact from climate risk shocks; on the other hand, due to the dispersive characteristics of industry activities, it is difficult for the policy signals transmitted by government attention to climate risks to be transformed into large-scale and centralized green investment momentum.

Table 6. Heterogeneity Analysis Results.

Variable	(1) East	(2) Central	(3) West	(4) Heavily Polluting	(5) Non-Heavily Polluting	(6) Manufacturing	(7) Non-Manufacturing
Cr	0.539	3.901 **	2.752 *	4.414 **	0.847	2.384 **	0.559
	(0.74)	(1.84)	(1.37)	(2.01)	(0.74)	(0.97)	(1.00)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	26,322	5837	4455	7638	28,978	23,585	13,031
R2	0.176	0.303	0.296	0.183	0.120	0.176	0.280

Note: * and ** indicate significance at the 10% and 5% levels, respectively.

4.5. Further Analysis: Economic Consequences

To explore the economic consequences of green investment, this paper uses Tobin's q to measure corporate value and conducts tests through model (4). Considering that the impact of green investment on corporate value has a non-linear characteristic, short-term concentrated environmental protection investment and lagging returns are likely to have a negative impact, while in the long run, with the maturity of green technologies and the release of policy dividends, returns will cover costs and boost value. This dynamic of "short-term negative and long-term positive" may present a "U-shaped" relationship [33]. Therefore, the square term of corporate green investment is introduced into the model to capture this non-linear correlation.

The regression results in column (1) of Table 7 show that the coefficient of the first-order term of green investment (Gi) is statistically significant and negative at the 1% level, while the coefficient of the quadratic term (Gi^2) is also statistically significant and positive at the 1% level. Moreover, the U-shaped curve relationship has passed the significance test. These findings confirm that there exists a significant U-shaped non-linear correlation between green investment and corporate value. As shown in Figure 3, given that the green investment variable has undergone a preprocessing of logarithmic transformation with a value of 1 added, the inflection point (TP = 8.7) derived from the regression is a value after logarithmic transformation. Recovered through inverse transformation, the inflection point of the original green investment is approximately 60,019,100 yuan. This implies that, when the scale of a firm's original green investment exceeds this threshold, its impact on corporate value shifts from an inhibitory effect to a promotional effect. Specifically, when the scale of green investment is below the inflection point, the cost attribute of environmental protection expenditure exerts a significant inhibitory effect on the current corporate value. In contrast, once the investment intensity crosses the inflection point, the long-term accumulated technological dividends, policy incentives and market reputation gains will be gradually released and offset the upfront investment costs, thereby generating a sustained positive driving effect on corporate value.

Table 7. Economic consequence results.

Variable	(1)	(2)
Gi	−0.052 ***	−0.027 ***
	(0.01)	(0.00)
Gi2	0.003 ***	0.003 ***
	(0.00)	(0.00)
Cr		−0.190
		(0.34)
Gi × Cr		−0.032

Table 7. *Cont.*

Variable	(1)	(2)
		(0.04)
$Gi^2 \times Cr$		0.001 **
		(0.00)
Controls	Yes	Yes
Industry Fixed	Yes	Yes
Year Fixed	Yes	Yes
N	36,149	36,149
R^2	0.052	0.065

Note: ** and *** indicate significance at the 5% and 1% levels.

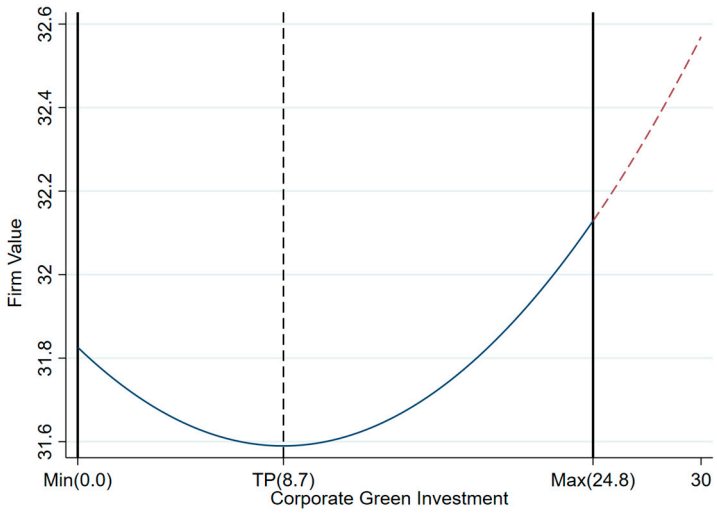


Figure 3. U-shaped characteristic of the impact of green investment on corporate value.

This study further introduces government attention to climate risks (Cr) as a moderating variable. The results in column (2) of Table 7 indicate that the coefficient of the interaction term between the quadratic term of green investment and government attention to climate risks is 0.001, which is statistically significant and positive at the 5% level. This suggests that government attention to climate risks significantly strengthens the U-shaped non-linear relationship between green investment and corporate value [34]. As shown in Figure 4, this moderating effect is specifically reflected in two interrelated characteristics: "left shift in the inflection point" and "steepening of the curve". The underlying economic logic is: (1) The inflection point of the U-shaped curve under high government attention shifts significantly to the left, which means that, in regions where the government attaches great importance to climate risks, enterprises can cross the threshold with lower green investment intensity and achieve positive returns on corporate value earlier. This phenomenon stems from the signal effect and resource effect generated by government behaviors. Strong government attention conveys clear and stable long-term policy signals to the market, effectively stabilizing enterprises' expectations of green investment returns and reducing their wait-and-see mood, thereby daring to make long-term strategic layouts. At the same time, high attention is often accompanied by substantial support such as R&D subsidies, green credit, and technical assistance. These resources directly offset the sunk costs of enterprises in the early stage of transformation, helping them pass the painful period of only input and no output faster, and significantly shortening the investment return cycle. (2) After crossing the inflection point, government attention further plays the role of a "return amplifier", significantly increasing the marginal return of green investment. The curve under high attention shows a steeper upward trend on the right side, indicating

that each additional unit of green investment can bring a greater increase in corporate value. This is mainly because government attention helps internalize the positive externalities of green investment. For example, part of the social benefits of energy conservation and emission reduction is returned to enterprises through subsidies and tax incentives, directly improving their private investment return rate. In addition, the mechanisms such as green benchmark selection and green supply chain requirements constructed by the government at the macro level have strengthened the competitive advantage of pioneering enterprises, enabling them to form brand premiums and seize emerging markets faster, thereby obtaining higher-valuation premiums in the capital market.

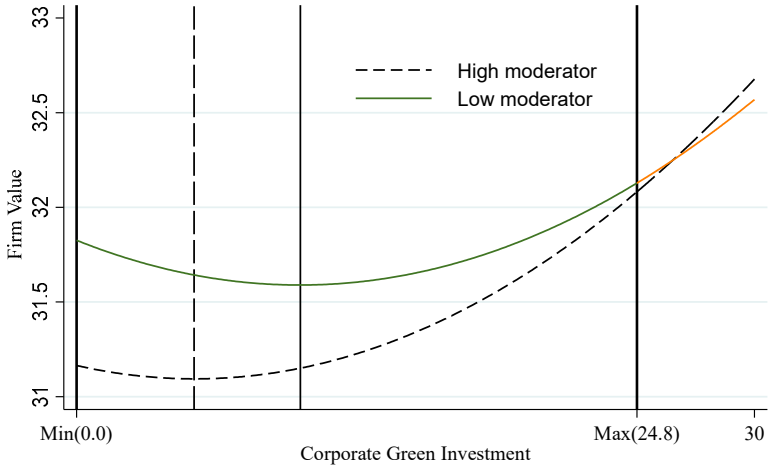


Figure 4. Moderating effect of government attention to climate risks.

5. Conclusions and Policy Recommendations

5.1. Research Conclusions

Taking Chinese A-share listed companies from 2010 to 2023 as samples, this paper explores the impact of government attention to climate risks on corporate green investment based on stakeholder theory. The core conclusions are as follows: Government attention to climate risks significantly promotes corporate green investment, which is reflected in the direct effect of "core demands—legitimacy response"; government environmental regulation and corporate green innovation indirectly increase corporate green investment through two paths: "institutionalization of demands—multi-subject constraints" and "demand adaptation—multi-subject incentives", respectively; heterogeneity analysis shows that this impact is more significant in central China, manufacturing, and polluting enterprises; and further economic consequence analysis shows that there is a U-shaped relationship between corporate green investment and corporate value. Government attention to climate risks significantly strengthens this U-shaped correlation by lowering the value return threshold of green investment and amplifying the marginal returns after crossing the threshold.

5.2. Policy Recommendations

Based on the above research conclusions, to optimize government climate governance, promote corporate green transformation, and help achieve the "dual carbon" goals, the following policy recommendations are proposed:

(1) Strengthen the transformation efficiency of "soft signals". Unify the core keywords of climate risk-related expressions in local policy documents to improve signal clarity and comparability; and incorporate attention to climate risks into the annual assessment of local governments to avoid policy fluctuations and stabilize long-term corporate expectations.

(2) Build a "constraint + incentive" environmental regulation system. Implement a progressive pollution penalty tax on the constraint side to force the withdrawal of high-carbon investment; increase subsidies for green technology R&D on the incentive side; and expand the scope of green credit interest subsidies and green bond support. Guide financial institutions to incorporate government climate attention into corporate credit rating, and promote core enterprises to establish green supply chain access mechanisms to activate multi-subject collaboration.

(3) Strengthen the direction guidance and resource support for green innovation. Issue a catalog of climate risk response technologies to clarify key support areas; establish a "government–industry–university–research" collaborative innovation fund, and provide tax reductions or rewards for corporate green patents; and launch special green innovation bonds to broaden corporate financing channels.

(4) Implement differentiated climate governance strategies. At the regional level, the central region should strengthen subsidies for industrial green technological transformation, the western region should improve green infrastructure, and the eastern region should guide market forces to take the lead; and at the industry level, implement "one enterprise, one policy" and mandatory environmental information disclosure for heavily polluting enterprises, promote industrial chain green certification for manufacturing, and formulate low-carbon standards for high-energy-consuming sub-sectors in non-manufacturing.

(5) Help enterprises cross the "U-shaped" inflection point of green investment. Provide phased special subsidies or tax rebates for enterprises before the inflection point to cover short-term costs; and accelerate the release of returns for enterprises after the inflection point through green brand certification and government procurement inclination. Guide institutional investors to hold shares of green enterprises for a long time to help enterprises achieve a smooth transformation.

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