

Climate Risk Disclosure on Total Factor Productivity in Enterprises

-- Evidence from the Chinese Market

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Abstract

Global climate risks have pushed regulators and corporations to ramp up climate disclosure rules over recent years. Many existing papers treat climate risk disclosure only as a symbolic signaling activity, yet we still know little about whether such disclosure delivers measurable gains in firm productivity. To clarify this debate, we draw on a 2017–2024 sample of Chinese A-share listed companies to test the link between climate disclosure quality and total factor productivity (TFP), alongside its internal transmission channels. We find consistent evidence that deeper climate disclosure raises firm TFP, and our robustness tests rule out the possibility that this link arises from random error. Mechanism tests confirm two key mediating channels: climate disclosure attracts more sustained analyst oversight and wider media coverage, both of which support efficiency growth. Heterogeneity results further show the positive impact is far more pronounced within state-owned firms and businesses based outside China's developed eastern provinces. Our findings go beyond simple correlation and illustrate that climate disclosure acts as a practical governance tool to reduce information frictions. This work expands the existing empirical record on the real economic outcomes of climate reporting and supplies concrete data support for policymakers refining current domestic climate disclosure requirements aligned with sustainable growth targets.

Keywords

Climate Risk Disclosure; Total Factor Productivity; Analyst Attention; Media Attention.

1. Introduction

Global climate hazards have drawn growing global governance attention since 2000, and cross-border climate risks now pose widespread challenges to all economies. To unify scattered global sustainability reporting rules, the International Sustainability Standards Board (ISSB) released the first two formal standards under the International Sustainability Disclosure Standards (ISDS) framework in June 2023; this milestone has greatly advanced consistent international climate disclosure practices[1]. Domestically, China has rolled out matching climate governance policies at a steady pace. The country first put forward dual carbon development goals in September 2020. Later in April 2024, guided by the China Securities Regulatory Commission (CSRC), the Shanghai, Shenzhen and Beijing stock exchanges jointly released unified sustainability reporting guidelines for listed firms. The document builds a localized disclosure system adapted to China's capital market features, keeps alignment with mainstream international disclosure rules, and adds more detailed clauses governing corporate climate risk information disclosure.

The Task Force on Climate-related Financial Disclosures (TCFD) classifies corporate climate risks into two core categories: physical risks and transition risks. Physical risks stem from

extreme weather shocks and gradual long-term climate shifts, which often bring direct losses to corporate production equipment and supply chain stability[2]. Transition risks arise from the global push for low-carbon transformation. Tighter environmental regulatory constraints, breakthroughs in clean production technology, shifting consumer demand for eco-friendly goods, and negative public reputational feedback may all alter corporate asset pricing and force businesses to restructure operating models, introducing financial and operational uncertainty[3]. Frequent climate disasters and stricter environmental oversight leave firms exposed to both physical and transition risks year after year[4]. Previous studies have confirmed that climate risks can substantially alter corporate survival prospects, long-term growth, and market valuation[5]. For this reason, capital market investors now demand clearer climate risk information from listed firms, pushing enterprises to raise their climate disclosure quality. Improvements in climate reporting will further change how businesses allocate internal resources and set operational plans, and total factor productivity (TFP) can well reflect the actual economic impacts of this transmission channel[6].

Total factor productivity acts as an essential metric to evaluate how enterprises allocate resources and arrange daily operations, carrying great practical significance for individual listed firms. Companies with high TFP levels can deliver equal or higher output while consuming less labor and capital input[6]. This competitive advantage cuts unit production costs and strengthens their ability to withstand external market volatility. These enterprises also manage internal resources more rationally: they allocate limited capital to high-return projects and avoid blind expansion with low economic returns. Given the national policy goal of high-quality economic growth, exploring how corporate climate risk reporting interacts with TFP carries great value for both theoretical research and industrial practice.

This work differs from existing academic studies in two distinct research dimensions, covering theoretical deduction and empirical testing.

From a theoretical perspective, the study constructs a dual-path mediation framework containing two external supervision subjects: analyst coverage and media exposure. It sorts out the complete transmission paths between climate risk disclosure and corporate TFP, enriching existing research on environmental information release and entity operational efficiency. When it comes to empirical design, this paper explores how institutional backgrounds and firm attributes change the efficiency effects brought by climate disclosure. It provides detailed micro-level evidence targeting emerging market economies and fills the gap of differentiated empirical evidence in previous research. Overall, the present study expands the research boundary of climate information disclosure from both theoretical and empirical perspectives.

2. Literature Review

2.1. Research on Climate Risk Disclosure

Scholars have carried out abundant discussions around corporate climate risk disclosure, and relevant studies can be roughly divided into three core strands: factors that drive disclosure, ways to quantify disclosure levels, and the economic outcomes brought by disclosure itself. When discussing what pushes firms to release climate information, external pressure from investor information demand acts as a key driving force for corporate disclosure decisions[7]. At the same time, internal demands to manage potential climate risks will also push enterprises to expand the range and depth of climate-related content in their public reports[8]. As for how researchers measure climate disclosure quality, early papers mostly adopted the environmental component scores from third-party ESG evaluation systems to stand in for firms' environmental information transparency. A growing number of recent studies have constructed targeted climate disclosure indicators by extracting textual content from annual and sustainability reports. Such multi-dimensional indicators cover carbon emission data of

Scope 1 to Scope 3, policy risks in the low-carbon transition process, and economic losses caused by extreme climate shocks[9]. In terms of economic outcomes, prior empirical evidence proves that transparent climate information can reduce information asymmetry in capital markets and relieve firms' financing pressure[10]. Several follow-up studies also point out that thorough climate disclosure can curb managers' short-sighted behaviors and drive more corporate investment in clean and low-carbon technologies[11]. Even so, most existing literature still uses generalized environmental disclosure indicators instead of climate-focused measurement tools. Few papers pay targeted attention to climate-specific information disclosure, which creates an obvious mismatch with the current regulatory shift toward more refined, climate-focused disclosure standards[1].

2.2. Research on Firm-Level Total Factor Productivity

TFP reflects the overall operational quality and resource allocation ability of individual enterprises, and it has long been regarded as a core yardstick for judging corporate high-quality development. Current academic research has identified a wide range of factors that can shape firm-level TFP, which can be summarized into macro contextual factors and micro corporate characteristics. From a macroscopic perspective, industrial planning policies, environmental regulatory intensity, digital infrastructure construction, and regional low-carbon transformation collectively affect the efficiency of industrial resource allocation. At the corporate micro level, TFP differences are largely driven by firm-specific conditions, including research and development input, financing status, internal governance quality, green investment behavior, and the degree of information disclosure transparency[12]. Focusing on the exogenous impact of China's new Environmental Protection Law, existing quasi-natural experimental evidence further confirms that mandatory environmental disclosure policies can effectively improve corporate productivity. Such policy effects are mainly realized through promoting green innovation behavior and optimizing the allocation of corporate capital resources[13].

2.3. Research on the Economic Consequences of Analyst and Media Attention

Analysts and media outlets act as critical external information intermediaries in the capital market. By mitigating information asymmetry between listed firms and external investors, both parties deliver effective external supervision and corporate governance functions. As professional market participants, analysts have outstanding information interpretation and analytical capabilities. They can reasonably assess the quality and content of corporate climate disclosure in annual reports, reduce investors' biased judgment on climate-related information, and restrain managers from making excessively high-carbon and low-efficiency investment decisions[14]. In addition, continuous analyst tracking can raise market recognition of firms' green research and development initiatives, helping enterprises obtain stable long-term value-oriented capital support[15]. Different from analyst professional supervision, media governance mainly relies on public reputation mechanisms. Persistent and in-depth media coverage of listed firms' climate behaviors and potential risk exposure enables investors and social stakeholders to form effective public supervision. Constrained by public opinion pressure, firms will proactively revise their climate governance arrangements, phase out backward high-carbon capacity, and optimize factor allocation and daily operational strategies to comply with low-carbon development requirements[9].

2.4. Literature Summary and Research Gaps

Existing studies have accumulated abundant empirical evidence concerning corporate climate disclosure behaviors, micro-level TFP driving factors, as well as the external supervisory functions of analysts and public media. These prior findings lay practical empirical foundations and theoretical references for the research design of this paper. Even so, current climate

disclosure research still contains obvious room for further improvement. Most empirical studies in this field adopt generalized environmental disclosure indicators rather than climate-oriented proxy variables, which cannot fit the increasingly refined climate disclosure regulatory requirements in recent years. In addition, existing research conclusions are relatively scattered. Few studies construct a complete logical chain that connects corporate climate disclosure, external information supervision, and micro operational efficiency. Moreover, prior literature focuses heavily on capital market feedback brought by environmental information, while ignoring how climate disclosure reforms can reshape corporate real economic productivity. Based on the above research shortcomings, this paper selects Chinese A-share listed firms from 2017 to 2024 as research samples to explore the actual impact of climate risk disclosure on enterprise TFP. Different from previous single-angle empirical tests, this study constructs a complete logical framework covering climate risk disclosure, external information intermediaries, and firm productivity changes. Adopting the classical text frequency calculation method based on text mining[16], we build a climate risk disclosure index (QHP) containing 96 TCFD-based keyword entries as the core explanatory variable. We also examine the dual mediating roles of analyst attention and media attention, so as to make up for the incomplete framework and insufficient micro-evidence in existing research. This study also provides reliable empirical support for the improvement of climate disclosure systems and corporate operational efficiency in emerging markets.

3. Theoretical Analysis and Hypothesis Formulation

3.1. Climate Risk Disclosure and Corporate Total Factor Productivity

Full climate risk reporting sends positive market signals that reflect a company's regulatory adherence, carbon reduction progress and long-term sustainable development goals. Such transparent reporting narrows information gaps between investors and businesses. It also expands financing access and cuts capital expenses, which creates steady funds to support daily business expansion and eco-friendly technical upgrades. Complete, standardized climate reporting pushes companies to measure their carbon output and identify existing obstacles in low-carbon transformation. Businesses will then adjust energy-heavy production workflows and put more capital into eco-focused research. They also remove outdated high-carbon assets and reorganize internal resource scheduling alongside daily management, which gradually lifts overall TFP.

H1: Climate risk disclosure positively promotes corporate total factor productivity.

3.2. The Mediating Mechanism of Analyst Attention

From the information management standpoint, thorough release of climate risk data reduces information barriers in capital markets. Analysts can obtain clear, usable written records and operational facts from these disclosures, which lessens the time and cost they spend gathering data and lowers errors in earnings forecasts. As a result, analysts are more willing to follow and monitor the firm over the long term. Continuous analyst tracking creates stronger market oversight and disciplinary pressure for listed firms. This external supervision limits wasteful capital expenditure, unreasonable resource allocation and lazy management attitudes. Firms will then standardize their decision-making processes and distribute internal resources more reasonably. Additionally, greater public exposure and reputational risks arising from analyst coverage push businesses to carry out carbon reduction reforms, technical upgrades and internal management adjustments. A series of such improvements steadily raise operational efficiency and further lift TFP.

H2: Climate risk disclosure improves corporate total factor productivity by boosting analyst attention.

3.3. The Mediating Mechanism of Media Attention

Enterprises that release complete, credible climate risk documents can present their sustainable operation layouts to outside investors clearly. Such transparent disclosures build trustworthy corporate reputations and attract balanced media reporting, which steadily expands the brand's market influence. Media supervision acts as an indispensable external governance restraint for listed firms. Clear climate information cuts down information gaps within capital markets, allowing businesses to acquire adequate funds and operational supplies. Sufficient resource reserves create favorable conditions for companies to lift operational performance. Constant media scrutiny also brings stronger supervision from ordinary investors and the public. Businesses will abandon outdated production modes that waste massive resources. They restructure internal management systems and resource allocation schemes, while pouring extra funds into environmental technical research. All these operational adjustments gradually raise operating efficiency and drive continuous growth of TFP.

H3: Climate risk disclosure improves corporate total factor productivity by raising media attention.

4. Research Design

4.1. Sample Selection and Data Sources

Our research sample covers Shanghai and Shenzhen A-share listed companies between 2017 and 2024. We clean raw data through four rounds of screening. Firms in the financial industry are removed first, alongside enterprises tagged ST, *ST or PT. Records with missing or distorted core variable data are then eliminated, and all continuous variables receive 1% two-sided winsorization to offset outlier bias. After data trimming, we get a panel dataset of 29,283 firm-year records. All firm operational and financial indicators are sourced from the CSMAR database.

4.2. Variable Definitions

4.2.1. Explanatory Variables

Climate risk disclosure serves as our core explanatory variable. Since China's climate disclosure regulatory system remains imperfect, mature dedicated climate disclosure datasets cannot be obtained directly. We refer to the text frequency measurement scheme from Du et al.[16] to build our indicator. With Python text processing tools, we sort through listed firms' annual reports and extract 96 climate-relevant keywords according to the classification standard of TCFD. The QHP index is calculated by dividing the total occurrences of these keywords by the total word count of each annual report, which reflects how thoroughly companies voluntarily disclose climate risks. We multiply this ratio by 100 to unify data dimensions and enhance regression stability.

4.2.2. Dependent Variable

This paper adopts LP-method TFP (TFP_LP) as the explained variable. Existing literature mainly relies on two mainstream OP and LP approaches to calculate firm-level total factor productivity. The LP estimator uses intermediate inputs to ease truncation bias, which makes it our baseline measurement choice.

Table 1. Variable Definitions

Category	Name	Symbol	Definition
Dependent Variable	Total Factor Productivity of Enterprises	TFP_LP	Total factor productivity estimated via the LP method
Key Explanatory Variables	Climate Risk Disclosure	QHP	The proportion of word frequency of 96 climate risk keywords in total annual report word count, multiplied by 100
Intermediary Variables	Analyst Attention	Analysis	Total number of analysts tracking the firm in the current year, plus 1, followed by natural logarithm transformation
	Media Attention	Media	Total number of news headlines mentioning the firm within a full year; add 1 and take the natural logarithm
Control Variables	Company Size	Size	Natural logarithm of total corporate assets
	Asset-Liability Ratio	Lev	Total liabilities / Total assets
	Return on Total Assets	ROA	Total net income / Average total assets
	Inventory Ratio	Inv	Net inventory / Total assets
	Operating Revenue Growth Rate	Growth	[Revenue in year t / (Revenue in year (t-1) - 1)] × 100%
	Tobin's Q	TobinQ	(Market value of tradable shares + Number of non-tradable shares × Net asset value per share + Book value of liabilities) / Total assets
	Shareholding Concentration	Top 1	Shareholding ratio of the largest shareholder
	Firm Listing Age	ListAge	Natural logarithm of (1 + years since IPO)
	Board Size	Board	Natural logarithm of the total number of directors on the board

4.3. Model Specification

This paper constructs a dual fixed-effect regression framework to assess the influence of corporate climate risk disclosure on firm-level TFP_LP. The specification is:

$$TFP_LP_{i,t} = \alpha + \beta_1 QHP_{i,t} + \gamma_1 Control_{i,t} + \mu_i + U_t + \varepsilon_{i,t} \quad (1)$$

where $TFP_LP_{i,t}$ denotes aggregate production efficiency calculated via the LP estimation approach; $QHP_{i,t}$ is the core explanatory variable (climate risk disclosure); $Control_{i,t}$ is the full set of control indicators; μ_i captures entity-specific fixed deviations; U_t stands for time-specific fixed components; and $\varepsilon_{i,t}$ is the error term.

4.4. Descriptive Statistics

Descriptive statistics prove all variables follow rational distribution without severe extreme outliers. The explained variable TFP_LP has a mean value of 8.719 and a standard deviation of 1.051, which reflects mild gaps in operational efficiency among sampled firms. The core explanatory variable QHP averages 0.184 with a standard deviation of 0.155. Its value ranges from 0.032 to 0.965, showing generally low climate disclosure levels and large gaps between different enterprises. As for mediator variables, analyst coverage averages 1.192 (SD=1.203),

and part of the sample receives zero analyst tracking. Media attention has a mean of 4.772 and a standard deviation of 1.367 with small overall fluctuation. All control variables have reasonable mean, standard deviation, and extreme values consistent with regularly listed firm operating features. Such reliable sample data lays a solid foundation for subsequent regression analysis.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
TFP_LP	28,609	8.719	1.051	6.650	11.563
QHP	28,609	0.184	0.155	0.032	0.965
Media	28,609	4.772	1.367	0.000	11.566
Analysis	28,609	1.192	1.203	0.000	3.807
Size	28,609	22.343	1.300	19.973	26.413
Lev	28,609	0.417	0.200	0.061	0.899
ROA	28,609	0.028	0.071	-0.298	0.197
Inv	28,609	0.130	0.112	0.000	0.621
Growth	28,609	0.118	0.334	-0.586	1.766
TobinQ	28,609	1.944	1.188	0.817	7.826
Board	28,609	2.091	0.195	1.609	2.565
Top 1	28,609	0.323	0.145	0.080	0.723
ListAge	28,609	2.210	0.809	0.693	3.434

4.5. Correlation Test

The correlation analysis shows that the dependent variable, firm total factor productivity (TFP_LP), exhibits a markedly positive correlation against the primary explanatory variable, climate risk disclosure (QHP), at the 1% statistical level, which aligns with the paper's central hypothesis. Additionally, QHP is significantly correlated with the mediating variables-analyst attention (Analysis) and media attention (Media)-at the 1% level, delivering preliminary empirical backing for the preset transmission pathways. Furthermore, we computed variance inflation factors (VIF) across every measurement item; the mean VIF stays under 10, indicating that multicollinearity among variables in the regression model is relatively minor, thus contributing to the trustworthiness of all estimated regression outputs.

Table 3. Correlation Test

	TFP_LP	QHP	Media 6	Analysis
TFP_LP	1			
QHP	0.174***	1		
Media	0.347***	0.051***	1	
Analysis	0.418**	0.075***	0.371***	1

Note: t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The same applies throughout.

5. Analysis of Empirical Results

5.1. Baseline Regression Analysis

Table 4 lays out the benchmark estimation outputs concerning the influence of climate risk disclosure on corporate TFP. The first column runs the regression without any control variables, while Column (2) adds all preset controls and controls for firm and year fixed effects

simultaneously. Estimation outcomes from both columns show the coefficient of QHP holds significantly positive significance at the 1% critical level. This outcome proves that more comprehensive climate risk reporting can effectively raise businesses' TFP, which provides statistical evidence to support H1.

Table 4. Baseline Regression Results

	(1)	(2)
	TFP_LP	TFP_LP
QHP	0.50981***	0.11376***
	(12.44)	(3.48)
Size		0.52964***
		(85.45)
Lev		0.02198
		(1.03)
ROA		0.97534***
		(29.07)
Inv		0.57545***
		(15.39)
Growth		0.17990***
		(34.12)
TobinQ		0.01171***
		(4.85)
Board		-0.05398***
		(-3.11)
Top 1		-0.03743
		(-0.96)
ListAge		-0.08316***
		(-8.64)
Id	yes	yes
year	yes	yes
_cons	8.62509***	-2.98244***
	(1111.17)	(-21.91)
N	28609	28,609
adj. R ²	0.916	0.947

5.2. Robustness Tests

Three separate robustness tests are conducted with firm and year fixed effects always controlled, including variable replacement, regional dummy supplementation, and cluster-adjusted standard errors. First, the outcome proxy gets replaced by aggregate production efficiency (TFP_OP) calculated via the OP estimation approach. The coefficient attached to the core explanatory variable, QHP, stays positively significant at the 5% level. Second, provincial dummy variables are inserted into the baseline model to capture regional heterogeneity, and the estimator of QHP retains positive statistical meaning at the 1% statistical level. Finally, clustered standard errors are deployed to resolve heteroscedasticity and intra-group correlation, and the QHP coefficient remains statistically significant at the 5% level. Throughout the three sets of reliability tests, the sign and statistical significance of the core explanatory variable remain largely consistent, and the estimated coefficients of the control variables are broadly aligned with figures yielded from the benchmark specification. These results fully demonstrate that the paper's core empirical deductions hold steady and credible.

Table 5. Robustness Tests

	Replacing the Dependent Variable	Inclusion of Provincial Dummy Variables	Inclusion of clustered standard errors
	TFP_OP	TFP_OP	TFP_LP
QHP	0.07655** (2.31)	0.11486*** (3.51)	0.11486** (1.98)
Size	0.37320*** (59.47)	0.53098*** (85.64)	0.53098*** (33.59)
Lev	-0.00639 (-0.30)	0.01816 (0.85)	0.01816 (0.38)
ROA	0.96190*** (28.31)	0.97716*** (29.11)	0.97716*** (15.58)
Inv	0.40884*** (10.80)	0.57548*** (15.36)	0.57548*** (6.08)
Growth	0.17337*** (32.48)	0.18147*** (34.45)	0.18147*** (20.59)
TobinQ	0.00782*** (3.20)	0.01130*** (4.68)	0.01130*** (3.18)
Board	-0.06667*** (-3.79)	-0.04998*** (-2.88)	-0.04998* (-1.91)
Top 1	-0.06871* (-1.75)	-0.03186 (-0.82)	-0.03186 (-0.41)
ListAge	-0.07548*** (-7.75)	-0.08283*** (-8.62)	-0.08283*** (-5.50)
Id	yes	yes	yes
year	yes	yes	yes
_cons	-1.23395*** (-8.95)	-3.02118*** (-22.18)	-3.02118*** (-8.59)
N	28609	28,609	28609
adj. R ²	0.922	0.947	0.947

5.3. Endogeneity Test

Table 6. Endogeneity Tests

	(1)	(2)
	QHP	TFP_LP
L.QHP	0.53134*** (79.53)	
QHP		0.28978*** (4.07)
Control variables	yes	yes
Id	yes	yes
year	yes	yes
N	22879	22879
adj. R2	0.080	0.184
F-test	664.98***	
LM statistic	5896.179***	
Wald F-statistic	6324.320 [16.38]	

This paper uses climate risk data delayed by one year (L.QHP) as an instrumental variable to ease potential endogeneity concerns. All regression models include fixed effects for individual companies and observation years. Data from Column (1) shows the lagged disclosure metric L.QHP has a significant positive correlation with the original QHP at the 1% critical level. Three test indicators-the F value, LM statistic and Wald F value-all meet standard significance requirements. This rules out weak instrument and underidentification problems and verifies the validity of the selected instrumental variable. Results in Column (2) still show QHP creates a notable positive impact on enterprise TFP at the 1% significance level. The coefficient's sign and significance match baseline regression results perfectly. After addressing endogeneity interference, the core conclusion remains unchanged: climate risk reporting helps lift corporate TFP. Such evidence proves the reliability of this paper's main research conclusions.

5.4. Mechanism Testing

5.4.1. Mechanism Test 1: Analyst Attention

Table 7. Mechanism Test 1: Analyst Attention

	(1)	(2)	(3)
	TFP_LP	Analysis	TFP_LP
QHP	0.11376***	0.18571**	0.10718***
	(3.48)	(2.42)	(3.29)
Analysis			0.03543***
			(12.80)
Size	0.52964***	0.60873***	0.50808***
	(85.45)	(41.83)	(79.36)
Lev	0.02198	-0.25199***	0.03091
	(1.03)	(-5.04)	(1.45)
ROA	0.97534***	1.56741***	0.91980***
	(29.07)	(19.89)	(27.28)
Inv	0.57545***	0.03165	0.57433***
	(15.39)	(0.36)	(15.41)
Growth	0.17990***	0.08653***	0.17683***
	(34.12)	(6.99)	(33.62)
TobinQ	0.01171***	0.18648***	0.00511**
	(4.85)	(32.89)	(2.07)
Board	-0.05398***	0.08660**	-0.05705***
	(-3.11)	(2.12)	(-3.30)
Top 1	-0.03743	0.08606	-0.04048
	(-0.96)	(0.94)	(-1.05)
ListAge	-0.08316***	-0.04937**	-0.08141***
	(-8.64)	(-2.19)	(-8.49)
Id	yes	yes	yes
year	yes	yes	yes
_cons	-2.98244***	-12.8587***	-2.52685***
	(-21.91)	(-40.23)	(-18.02)
N	28609	28,609	28609
adj. R ²	0.947	0.777	0.947

This paper adopts a three-stage regression specification to examine the mediating influence of analyst attention (Analysis). All three regressions control for firm and year fixed effects. The

outputs within Column (1) align with the benchmark regression, demonstrating that climate risk disclosure (QHP) delivers a distinctly favorable driving force toward firms' TFP at the 1% level. Column (2) reveals that QHP substantially lifts analyst attention at the 5% level, which reveals that fuller climate risk disclosure raises enterprises' odds of drawing analyst tracking. Column (3), which includes both QHP and the mediating variable Analysis, shows that both coefficients retain positive statistical significance at the 1% level, while the coefficient on QHP shrinks marginally in contrast to Column (1). This implies that analyst attention undertakes a partial mediating function. Put differently, climate risk disclosure not only directly lifts firms' TFP but also generates an indirect impact via boosting analyst attention, thereby confirming the proposed mediating mechanism.

5.4.2. Mechanism Test II: Media Attention

Table 8. Mechanism Test 2: Media Attention

	(1)	(2)	(3)
	TFP_LP	Media	TFP_LP
QHP	0.11376***	0.28154**	0.11243***
	(3.48)	(2.33)	(3.44)
Media			0.00474***
			(2.69)
Size	0.52964***	0.45066***	0.52751***
	(85.45)	(19.67)	(84.43)
Lev	0.02198	0.06402	0.02167
	(1.03)	(0.81)	(1.02)
ROA	0.97534***	-0.16154	0.97610***
	(29.07)	(-1.30)	(29.09)
Inv	0.57545***	0.11949	0.57489***
	(15.39)	(0.86)	(15.37)
Growth	0.17990***	0.05825***	0.17962***
	(34.12)	(2.99)	(34.07)
TobinQ	0.01171***	0.15235***	0.01099***
	(4.85)	(17.06)	(4.52)
Board	-0.05398***	-0.13388**	-0.05335***
	(-3.11)	(-2.09)	(-3.07)
Top 1	-0.03743	-0.46621***	-0.03522
	(-0.96)	(-3.25)	(-0.91)
ListAge	-0.08316***	-0.02528	-0.08304***
	(-8.64)	(-0.71)	(-8.63)
Id	yes	yes	yes
year	yes	yes	yes
_cons	-2.98244***	-5.20381***	-2.95777***
	(-21.91)	(-10.34)	(-21.68)
N	28,609	28,609	28609
adj. R ²	0.947	0.573	0.947

This paper further introduces media attention (Media) as a mediating variable and constructs a three-step regression model to examine its transmission mechanism within the correlation connecting climate risk disclosure and firms' TFP. All regressions control for firm-level and year-level fixed effects. The baseline results in Column (1) statistical outputs presented in Column (1) illustrate that climate risk disclosure (QHP) delivers a prominently favorable driving force on firm total factor productivity (TFP_LP) at the 1% level, indicating that the main effect is robust. The computed figures within Column (2) uncover that the estimator corresponding to QHP is positively significant at the 5% level, suggesting that greater climate risk disclosure effectively enhances media attention. In other words, proactive climate disclosure conveys signals of green development to the market and attracts greater media coverage. In Column (3), after including both the core explanatory variable and the mediating variable in the model, the coefficient on Media maintains positive statistical significant at the 1% level, while the coefficient on QHP remains significantly positive but decreases slightly relative to the baseline model. This confirms that media attention plays a notable partial mediating function within the process through which climate risk disclosure affects firms' TFP.

5.5. Heterogeneity Analysis

To unpack differentiated productivity shifts brought by corporate climate risk disclosure, this study runs subsample tests split by the ownership structure of firms and the geographic location of enterprises. All estimation models control individual and annual fixed effects.

5.5.1. Ownership Structure

Grouped regression results show that QHP exerts a significant positive effect on TFP at the 1% level for state-owned enterprises, while no statistically significant correlation is observed in non-state-owned samples. This reveals climate risk disclosure lifts firm TFP, with this favorable effect far more salient within state-owned businesses. Such disparity arises because state-owned firms bear more green policy assignments and social accountability, while facing rigorous monitoring from regulators, mass media, and the general public. Their comprehensive, actionable climate information disclosures advance internal green transition and rational resource allocation. By contrast, non-state-owned firms face weaker institutional restraints. Most of them only fulfill disclosure rules out of passive compliance, so climate transparency cannot deliver tangible productivity gains.

5.5.2. Geographic Location

Subsample regression estimates show climate disclosure carries positive significant coefficients for enterprises across eastern and non-eastern Chinese areas. The metric for non-eastern firms registers significance at the 1% level with a larger numerical value, while eastern counterparts only satisfy the 5% statistical level. Such contrast reflects that climate information transparency generates more prominent productivity growth for non-eastern businesses. Eastern territories feature mature marketization, standardized corporate governance, and streamlined resource allocation, which narrows the marginal productivity gains brought by climate risk disclosure. In comparison, non-eastern regions suffer from weaker information disclosure environments, incomplete internal governance, and prevalent resource misallocation. For these firms, standardized climate information disclosure effectively reduces information asymmetry, regulates operational behaviors, and remedies governance deficiencies, thus generating more obvious marginal promotion on TFP.

Table 9. Heterogeneity Tests

	State-Owned Enterprises	Non-SOEs	Eastern Region	Non-Eastern Regions
	TFP_LP	TFP_LP	TFP_LP	TFP_LP
QHP	0.22036*** (3.95)	0.06047 (1.49)	0.08074** (2.08)	0.16765*** (2.72)
Size	0.48713*** (38.42)	0.54061*** (73.75)	0.52969*** (72.56)	0.51238*** (42.58)
Lev	-0.01580 (-0.35)	0.01976 (0.80)	0.00660 (0.26)	0.06236 (1.52)
ROA	1.63751*** (20.51)	0.81133*** (21.97)	0.86543*** (22.46)	1.28029*** (18.77)
Inv	0.09365 (1.43)	0.84813*** (18.36)	0.59244*** (13.63)	0.53597*** (7.25)
Growth	0.19322*** (20.12)	0.17980*** (28.85)	0.19384*** (30.81)	0.16117*** (16.66)
TobinQ	0.00082 (0.14)	0.01156*** (4.36)	0.01299*** (4.60)	0.00862* (1.85)
Board	-0.00809 (-0.25)	-0.05737*** (-2.73)	-0.08351*** (-4.10)	0.03529 (1.07)
Top 1	0.14158** (1.99)	-0.23620*** (-4.74)	-0.05399 (-1.18)	-0.02743 (-0.37)
ListAge	-0.04111* (-1.65)	-0.09734*** (-8.50)	-0.08251*** (-7.42)	-0.06004*** (-3.03)
Id	yes	yes	yes	yes
year	yes	yes	yes	yes
_cons	-2.07284*** (-7.11)	-3.20930*** (-20.22)	-2.89202*** (-18.08)	-2.91388*** (-10.96)
N	8263	20,346	20,913	7,696
R2	0.964	0.950	0.957	0.957
adj. R ²	0.956	0.938	0.948	0.948

6. Conclusion and Implications

6.1. Core Empirical Findings

The sample of this research covers all A-share listed enterprises on the Shanghai and Shenzhen stock exchanges from 2017 to 2024. This paper conducts quantitative analysis to explore the correlation between climate risk reporting and corporate TFP, alongside the hidden intermediate paths connecting the two indicators. Key test results are sorted out as follows. There exists a significant positive correlation between climate risk disclosure and enterprise TFP. More comprehensive climate information release helps enterprises improve operational efficiency, and this core conclusion remains reliable after multiple robustness tests. Tests on transmission channels prove that climate risk reporting lifts corporate TFP by attracting more analyst follow-up and media attention. Heterogeneity tests further show that the efficiency promotion effect of climate disclosure is more obvious in state-owned enterprises and businesses located in non-eastern regions.

6.2. Policy and Corporate Implications

Drawing on all estimation results derived above, this study delivers targeted policy guidance and operational references for enterprises.

First of all, listed entities need to perfect their internal climate information release frameworks and build sound management workflows for climate-related risks. Instead of only fulfilling mandatory reporting rules out of passive compliance, businesses ought to integrate climate risk screening, evaluation and countermeasure design into long-run strategic layout. They are supposed to customize carbon-cutting plans matching their own industrial traits and revise operation frameworks correspondingly. High-quality climate disclosures can attract sustained analyst monitoring and increase positive media coverage. By leveraging the oversight functions of these two external information intermediaries, firms can optimize resource allocation and improve TFP.

Second, official regulators and government departments ought to set unified specifications for climate risk reporting. Consistent disclosure rules cut scattered, inconsistent corporate information releases, reduce the data collection burden for market analysts and open up more channels for media supervision. Such orderly information delivery amplifies the transmitting value of outside monitoring subjects, turning published climate data into tangible upgrades to firms' daily operation and production performance.

Third, authorities need to roll out varied regulatory rules and supportive measures according to enterprises' property rights nature and regional distribution. Private businesses may receive targeted policy aid including convenient loan services and tax subsidies, which lessens their compliance expenses and lets climate reporting exert stronger practical effects. As for companies operating in non-eastern zones, local administrators should refine supporting reporting mechanisms. Well-designed climate disclosure remedies internal governance loopholes, eases capital market information barriers and brings more obvious efficiency growth. As for eastern listed corporations, continuous regular capital market supervision can fully tap into extra economic value brought by transparent climate information.

6.3. Limitations and Future Research

This research provides actionable real-world insights yet comes with multiple built-in analytical restrictions, notwithstanding thorough model validation and repeated stability testing. Such drawbacks create meaningful research space for subsequent related studies.

This paper selects only Chinese A-share listed firms from 2017 to 2024 as research subjects. As listed enterprises are subject to mandatory environmental disclosure rules and have abundant financing resources, their operational and information disclosure behaviors are relatively standardized. In comparison, unlisted private firms and SMEs lack unified climate disclosure constraints and external market supervision. For this reason, the core conclusions obtained from listed samples cannot be fully generalized to unlisted enterprises, which weakens the external applicability of the research findings. Future studies can adopt questionnaire surveys and other data collection methods targeting unlisted manufacturing firms to re-examine the economic consequences of climate disclosure and enrich relevant micro-level empirical evidence. When it comes to variable quantification, the climate disclosure indicator built within this paper relies entirely on textual information extracted from corporate annual filings, lacking a classification standard to separate authentic green management acts from superficial symbolic disclosure. A handful of listed firms issue shallow climate-related descriptions only to satisfy regulatory mandates, with no corresponding capital input for low-carbon upgrades or internal operational adjustments. Follow-up scholars can develop multi-criteria assessment frameworks to tell apart real climate governance efforts and greenwashing practices, so as to compare how these two distinct disclosure types generate disparate productivity outcomes for businesses. Besides, this paper only confirms that analyst tracking and media oversight function as parallel mediating channels. The study fails to analyze how contextual factors adjust the core relationship, including local environmental enforcement strength, executives' environmental awareness and access to eco-oriented financing. Integrating such multilevel

moderators would enable a more nuanced and theoretically grounded framework linking climate disclosure to corporate performance.

More broadly, future work could extend the scope across emerging economies to examine how institutional heterogeneity shapes the economic implications of climate disclosure-or leverage longitudinal panel data spanning ten or more years to investigate the dynamic, long-run effects of climate information transparency on corporate productive efficiency.

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