

Can Carbon Information Disclosure Enhance Firms' New Quality Productivity? Evidence from Empirical Analysis of Chinese Listed Companies

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Abstract

As global efforts to tackle climate change deepen, the role of carbon information disclosure in enhancing the new quality productivity of enterprises has attracted growing attention. This paper, using data from Chinese listed companies between 2015 and 2023, investigates the effect of carbon information disclosure on new quality productivity in enterprises and the mechanisms behind it. The research indicates that enhancing carbon information disclosure can significantly boost corporate new quality productivity, with green technological innovation, analyst attention, and financing constraints serving as key mediators in this process. Moreover, heterogeneity analysis shows that state-owned enterprises, heavy-polluting industries, and companies in the central and western regions demonstrate more significant effects in promoting new quality productivity through carbon information disclosure. Further investigation reveals that the quality of corporate environmental information disclosure, the implementation of the "dual carbon goals" policy, and the level of marketization significantly enhance the motivational impact of carbon information disclosure on new quality productivity improvement. This research not only offers theoretical support for government carbon information disclosure policies but also provides practical guidance for enterprises to foster green innovation and improve their core competitiveness.

Keywords: Carbon information disclosure; Green innovation; Financing constraints; Analyst attention; New quality productivity

1. Introduction

As the challenge of global climate change grows increasingly severe, addressing climate change has become a critical task for governments and firms worldwide. Particularly under the framework of the Paris Agreement, enhanced controls and oversight of carbon emissions have been implemented globally, fostering the development of a low-carbon economy. Within this context, carbon information disclosure has emerged as a key instrument in corporate environmental governance, capturing significant attention from both academia and policymakers. Carbon information disclosure serves not only as a manifestation of corporate social responsibility but also potentially influences firms' innovation, production efficiency, and long-term competitiveness. This is especially pertinent in China, where the government has introduced a series of policies supporting the "Dual Carbon Goals" (carbon peak and carbon neutrality). Consequently, corporate carbon information disclosure practices under this framework are increasingly recognized as a vital pathway towards achieving green transformation. However,

despite the growing environmental significance of carbon information disclosure, there remains a lack of systematic empirical evidence regarding the specific mechanisms and effects through which carbon information disclosure enhances firms' new quality productivity.

China's economy has experienced over four decades of rapid growth since the initiation of reform and opening-up. However, the factor input-driven growth model has increasingly revealed problems of high resource consumption and low efficiency. Particularly as economic development transitions into a stage of high-quality growth, improvements in corporate productivity have become progressively reliant on technological innovation and the enhancement of total factor productivity (Chen et al., 2024; M. Lu et al., 2025). The advancement of new quality productivity pertains not only to breakthroughs in corporate technology and management but also involves fostering coordinated development in green innovation, resource allocation, and environmental responsibilities amidst pressures from global environmental changes and the green economic transition. As a component of corporate green innovation, the relationship between carbon information disclosure and firms' new quality productivity has attracted growing academic attention, though relevant research remains in its nascent stage.

Existing literature primarily explores the relationship between information disclosure and corporate innovation or productivity, suggesting that environmental information disclosure enhances corporate transparency, builds investor trust, and thereby promotes long-term corporate development (Feng et al., 2025; Z. Liu et al., 2025). Concurrently, studies indicate that CID, as a novel environmental governance tool, can incentivize firms to adopt greener and more sustainable development strategies (Saba et al., 2023; M. Wang et al., 2025). However, research on how carbon information disclosure influences firms' new quality productivity through multiple mechanisms—such as green technological innovation, alleviation of financing constraints, and market-oriented reforms—remains scarce. Moreover, existing studies predominantly focus on multinational corporations or specific industries, lacking in-depth analysis of firms within China's unique context. In recent years, as financial markets increasingly emphasize corporate environmental responsibility, carbon information disclosure has gradually evolved into a crucial component of corporate competitiveness. By disclosing their carbon emissions and mitigation measures, firms can attract greater investor attention and market recognition, consequently enhancing their innovation capabilities and production efficiency (Shao & Xue, 2024; X. Zhang et al., 2025). Simultaneously, analyst attention to carbon information can also impact firms' financing environment, alleviating their financing constraints (Bai et al., 2024; Zhang & Qi, 2025). Within this context, carbon information disclosure is not merely an act of corporate social responsibility; it may also serve as a significant driver for advancing green technological innovation and boosting productivity.

Drawing on data from Chinese listed companies spanning 2015 to 2023, this paper investigates the impact of carbon information disclosure on firms' new quality productivity and its underlying mechanisms. The findings demonstrate that enhanced carbon information disclosure significantly promotes the improvement of firms' new quality productivity, with corporate green innovation, analyst attention, and financing constraints acting as crucial mediating channels in this process. Further analysis reveals that the quality of corporate environmental information disclosure, the implementation of the government's "Dual Carbon Goals" policy, and the level of marketization significantly amplify the incentive effects of carbon information disclosure on new quality productivity enhancement. Heterogeneity analysis further indicates that the positive effect

of carbon information disclosure on new quality productivity is more pronounced for state-owned enterprises (SOEs), firms in heavily polluting industries, and companies located in the central and western regions of China.

The main contributions of this study are as follows: First, it innovatively integrates five key elements—carbon information disclosure, green innovation, financing constraints, analyst attention, and new quality productivity—to construct a novel analytical framework. This framework deeply dissects the intrinsic mechanism through which carbon information disclosure enhances firms' new quality productivity by promoting green innovation, increasing analyst attention, and alleviating financing constraints. Unlike prior research predominantly focused on the environmental or corporate social responsibility impacts of carbon information disclosure (Yun & Hu, 2025; S. Zheng et al., 2025), this paper systematically integrates the relationship between carbon information disclosure and corporate new quality productivity, offering fresh insights for theoretical exploration of low-carbon transition and productivity transformation. By revealing the mediating roles of green innovation, financing constraints, and analyst attention between carbon information disclosure and corporate productivity, this study not only fills the academic gap regarding the link between low-carbon transition and productivity transformation but also strengthens the theoretical foundation, advancing theoretical progress on green innovation and high-quality corporate development (Dong et al., 2025; Y. Liu et al., 2025). Second, the empirical research validates the significant promotive effect of carbon information disclosure on firms' new quality productivity and elucidates the critical roles of green innovation, analyst attention, and financing constraints within this process. This finding provides robust empirical support for policy making. Particularly against the backdrop of the global transition towards a low-carbon economy, this study offers a scientific basis for governments formulating carbon information disclosure policies. Furthermore, it provides investors with a new perspective for evaluating corporate sustainability: by assessing the extent of carbon information disclosure, investors can gauge a firm's potential for green innovation and productivity, enabling more informed investment decisions (Huang et al., 2025; Song et al., 2024). Third, the paper delves into the influence of heterogeneous firm factors—such as ownership type, industry pollution intensity, and geographical location—on the relationship between carbon information disclosure and new quality productivity. Existing literature primarily concentrates on the impact of broad macroeconomic factors on carbon information disclosure (Senna & de Araujo Moxotó, 2025), paying less attention to firm-level heterogeneity. By analyzing different types of firms, this study uncovers the differential effects of carbon information disclosure on new quality productivity enhancement for SOEs, firms in heavily polluting industries, and enterprises in central and western China. This provides a scientific basis for governments to formulate differentiated policies, enhancing their precision and effectiveness (Gao et al., 2025; Hu et al., 2025). Fourth, the study explores how factors such as the quality of environmental information disclosure, the "Dual Carbon Goals," and the level of marketization moderate the effect of carbon information disclosure on firms' new quality productivity improvement. Especially under the "Dual Carbon Goals" policy, governmental guidance and optimized market environments are crucial for carbon information disclosure's impact. Relevant research indicates that policy drivers can effectively enhance corporate green innovation capability (C. Li et al., 2025; Yang et al., 2025), while marketization levels promote the diffusion and application of green technologies by improving information symmetry (Du et al., 2024; H. Lu et al., 2025). Through systematic empirical analysis, this paper

reveals the moderating effects of these factors, offering novel insights and policy implications for firms on optimizing carbon information disclosure.

The remainder of this paper is structured as follows: Section 2 presents the literature review. Section 3 details the theoretical analysis and research hypotheses. Section 4 describes the model, variables, and data. Section 5 reports the empirical results and analysis. Section 6 provides further analysis. Finally, Section 7 concludes and discusses policy implications.

2.Theoretical Analysis and Research Hypotheses

In examining the impact of carbon information disclosure on new quality productivity , this study performs an in-depth analysis from various dimensions. On the one hand, it examines the direct effect of carbon information disclosure on new quality productivity . On the other hand, it identifies and investigates potential mediating effects to explain how carbon information disclosure affects new quality productivity through various mechanisms. (Figure 1 for detail).

2.1Carbon Information Disclosure and Firms' New Quality Productivity

As a critical component of corporate climate change response, carbon information disclosure is not only a manifestation of corporate social responsibility but has also emerged as a significant factor in driving the enhancement of firms' new quality productivity. According to signaling theory, firms use carbon information disclosure to signal their efforts and achievements in environmental governance, carbon reduction, and sustainable development to external stakeholders. This transparent disclosure effectively reduces information asymmetry and mitigates cognitive biases among investors, consumers, creditors, and other stakeholders regarding a firm's environmental performance, thereby enhancing its market competitiveness and innovation capacity(Barg et al., 2024; Lan et al., 2025).

On one hand, carbon information disclosure contributes to improving firms' resource allocation efficiency and drives new quality productivity enhancement through market mechanisms. In capital markets, improved carbon information disclosure allows investors to more accurately identify firms with high environmental governance standards and innovation capabilities, increasing their willingness to invest capital in these firms (Feng et al., 2025; Wu et al., 2024). Carbon information disclosure enhances information transparency in capital markets, alleviates problems of adverse selection and moral hazard, and channels funds towards firms excelling in green technological innovation and sustainable development, thereby promoting new quality productivity improvement. Concurrently, carbon information disclosure can attract more investors focused on environmental and sustainable investing, providing firms with financial support and reducing financing costs (D'Arcangelo et al., 2025). Furthermore, enhanced carbon information disclosure incentivizes firms to increase investment in green technological innovation, boost green production efficiency and product value-added, further elevating their new quality productivity(Sun & Yang, 2024; Wang, 2025).

On the other hand, carbon information disclosure also facilitates stakeholder oversight and incentive mechanisms, compelling firms to enhance their new quality productivity. When firms disclose their carbon emissions data and climate action measures, stakeholders—particularly governments, consumers, and environmental organizations—scrutinize and evaluate their environmental performance(Kloppenburger et al., 2022). Firms disclosing high carbon emissions or failing to meet sustainability standards face pressure from public opinion, consumer trust erosion, and government policies. Such pressure compels firms to adopt more proactive measures to improve their environmental performance, accelerate the adoption of green technologies, enhance

the production capacity of green products, and consequently boost new quality productivity (Deng & Zhang, 2025; Hu et al., 2024).

In credit markets, financial institutions often utilize carbon information disclosure to assess firms' environmental risks and sustainable development potential. Green credit policies thus constitute a key mechanism through which carbon information disclosure promotes new quality productivity enhancement. High-quality carbon information disclosure improves a firm's creditworthiness, granting it an advantageous position in securing financial support and alleviating financing constraints (M. Zheng et al., 2025). Financial institutions can differentiate between green and non-green firms, offering preferential green loans to fund green transformation and innovation projects, further fostering new quality productivity improvement.

From a consumer behavior perspective, heightened environmental awareness has led consumers to increasingly prefer green products and be willing to pay a premium for them (M. Zheng et al., 2025). Through carbon information disclosure, firms can cultivate a green brand image, attract more environmentally conscious consumers, and enhance market competitiveness. Simultaneously, the demand for green products incentivizes firms to prioritize the application of green technologies in production processes, thereby increasing new quality productivity. Particularly in an era of intensifying global competition, firms leveraging the competitiveness of green products and technologies can differentiate themselves and achieve long-term competitive advantages.

Moreover, carbon information disclosure can amplify a firm's influence within its industrial and supply chains. As global emphasis on environmental protection and sustainability grows, more upstream suppliers and downstream customers prefer to partner with firms demonstrating strong environmental performance (Golgeci et al., 2021). Carbon information disclosure strengthens trust among supply chain partners, fosters green collaboration within the supply chain, and further propels corporate green innovation and productivity enhancement.

Therefore, carbon information disclosure not only drives new quality productivity enhancement through market mechanisms but also compels green transformation through stakeholder oversight mechanisms. By increasing corporate transparency and social responsibility, carbon information disclosure promotes new quality productivity improvement across multiple dimensions, including capital, products, labor, and supply chains (Y. Liu et al., 2025; Y. Wang et al., 2025).

In summary, carbon information disclosure, serving as a vital bridge connecting firms with the market, provides a powerful impetus for new quality productivity enhancement by increasing information transparency, improving resource allocation efficiency, promoting green innovation, and incentivizing better environmental performance.

Consequently, we propose **Hypothesis 1: Carbon information disclosure promotes the enhancement of firms' new quality productivity.**

2.2 Mechanism Analysis

2.2.1 Carbon Information Disclosure, Financing Constraints, and New Quality Productivity

Carbon information disclosure plays a pivotal role in alleviating financing constraints and attracting capital, which in turn enhances new quality productivity. As global green finance policies intensify, carbon disclosure has become a crucial tool for assessing a firm's environmental and innovation capabilities (Wang & Yang, 2024). By publicly sharing their carbon emissions,

energy usage, and sustainability measures, firms signal their commitment to green development, making them more attractive to investors. This not only lowers financing costs but also facilitates capital inflows, alleviating financial constraints (M. Zhang et al., 2025).

This increased transparency helps to reduce information asymmetry in capital markets, allowing investors to better assess a firm's environmental risks and mitigation strategies. As a result, firms with high-quality carbon disclosure can secure funding more easily, especially through green financing products like green bonds and loans, which are designed to support green innovation and R&D (He et al., 2023). By accessing these financial resources, firms can invest in green technologies and enhance their productivity.

Moreover, carbon information disclosure can optimize internal governance by necessitating the planning and management of energy use and carbon emissions. Effective management in these areas not only helps firms comply with national policies but also motivates investment in green technologies. This internal transformation boosts productivity, particularly in innovation, technical efficiency, and green product development (Fang & Tan, 2023).

Through this mechanism, carbon information disclosure reduces financing constraints by facilitating easier access to capital, supports green investment, and strengthens firms' competitiveness in green innovation. As firms attract more investment, they can pursue sustainable projects that contribute to long-term productivity growth.

Hypothesis H2: Carbon information disclosure enhances firms' new quality productivity by alleviating financing constraints.

2.2.2 Carbon Information Disclosure, Green Innovation, and New Quality Productivity

Carbon information disclosure is a key driver of green innovation, which in turn fosters new quality productivity. By publicly sharing their carbon emissions, energy usage, and environmental initiatives, firms demonstrate their commitment to sustainable development, aligning with global green policy trends (Li et al., 2024). These disclosures make firms more attractive to investors who prioritize sustainability, boosting their market valuation and enabling them to secure additional capital for green technology R&D. The capital inflow accelerates the development of green innovations, which improves firms' productivity and long-term competitiveness.

Carbon disclosure also promotes green innovation by encouraging firms to invest in sustainable technologies and environmentally friendly projects. These investments reduce carbon emissions, optimize resource allocation, and enhance production processes. For firms demonstrating strong environmental performance, carbon information disclosure not only increases investor confidence but also enhances their innovation capacity (Chang et al., 2025; Dou et al., 2025). As green innovation accelerates, firms' productivity improves, contributing to economic growth and sustainable development.

Moreover, by reducing information asymmetry, carbon disclosure makes it easier for investors to assess the risks and potential rewards of investing in green innovation. Firms that disclose carbon reduction targets and environmental measures attract investors looking for sustainable investment opportunities. This increases their ability to secure funding, which further supports innovation in green technologies and sustainable development (S. Zheng et al., 2025). As firms continue to innovate and develop green products, their productivity rises, and their market position strengthens.

The interaction between carbon information disclosure and green innovation creates a virtuous cycle. As firms innovate and improve their productivity, they attract more investment,

which enables further innovation and productivity enhancement. This cycle boosts the firm's competitiveness in the market and contributes to its long-term sustainability.

Hypothesis H3: Carbon information disclosure enhances firms' new quality productivity by promoting green innovation.

2.2.3 Carbon Information Disclosure, Analyst Attention, and New Quality Productivity

Carbon information disclosure also increases analyst attention, which in turn boosts firms' market visibility and attractiveness to investors. The transparency provided by carbon disclosure allows analysts to better evaluate a firm's progress on environmental goals, green innovation, and sustainability initiatives. This increased transparency fosters trust in the firm's long-term viability and enhances its market valuation(Raimo et al., 2024).

Analysts use carbon disclosure as a key factor when evaluating a firm's green technological innovations and carbon management measures. The more analysts track these disclosures, the more they can assess the firm's ability to meet sustainability targets and innovate. This leads to higher market visibility, greater investor confidence, and an increased willingness to invest in the firm (Li & Yao, 2025). As a result, firms that disclose carbon information are more likely to attract long-term investors who are committed to sustainable investments.

Increased analyst attention also encourages firms to further enhance their green innovation efforts. Analysts closely following the firm's carbon disclosure reports often highlight its progress in green technologies and environmental sustainability. This public attention motivates firms to intensify their efforts in innovation, improve production processes, and develop green products, which in turn drives productivity growth (Yang & Che, 2025; Zhou et al., 2025).

As analysts focus on firms' environmental performance, their reports influence investor decisions, which can lead to increased stock liquidity and greater capital support for innovation projects. This creates a positive feedback loop where analyst attention fuels productivity improvements, and productivity improvements attract even more analyst attention and capital investment.

Hypothesis H4: Carbon information disclosure enhances firms' new quality productivity by increasing analyst attention.

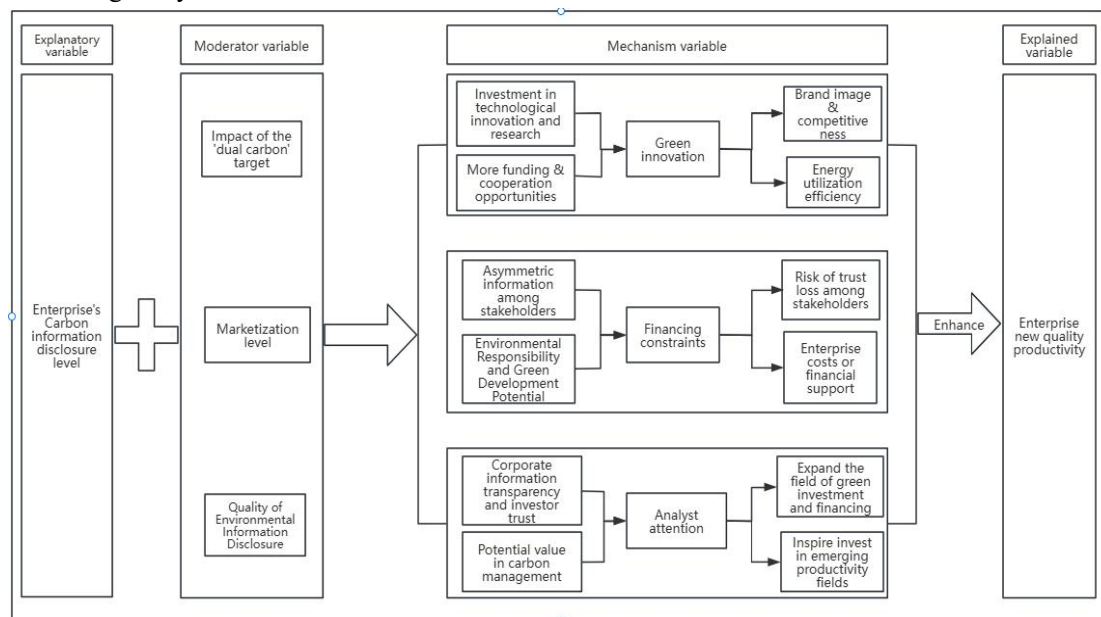


Figure 1 Diagram of the theoretical mechanism

3. Research Design

3.1 Sample and Data Sources

This study utilizes annual data from A-share listed companies on the Shanghai and Shenzhen Stock Exchanges spanning 2015 to 2023 to analyze the impact of carbon information disclosure (CID) on firms' new quality productivity (new quality productivity). To ensure the rigor and reliability of the findings, the raw data underwent stringent screening and processing. The specific procedures are as follows: (1) Relevant financial and non-financial data were obtained from the CSMAR Database; (2) Firms in the financial and insurance industries were excluded to mitigate industry-specific confounding effects; (3) ST and *ST companies (firms under special treatment or delisting risk warnings) were removed, as these entities often exhibit abnormal financial conditions or other special circumstances that could compromise the robustness of the analysis; (4) Observations with missing values for the dependent variable or control variables were dropped to ensure data completeness; (5) Continuous variables were winsorized at the top and bottom 1% to reduce the influence of outliers; (6) Firms with fewer than 10 employees were excluded to ensure the selected sample possesses adequate scale and representativeness. The primary data sources for this study include the CSMAR Database, corporate annual reports, and social responsibility reports. By synthesizing data from these sources, this paper systematically analyzes the influence of CID, green innovation, and other factors on firms' new quality productivity, providing a more comprehensive and accurate empirical foundation for the research.

3.2 Variable Definitions

3.2.1 Dependent Variable: New Quality Productivity (Npro)

Drawing on the research of Ruanzhou and Guo (2025) on new quality productivity, this study quantifies new quality productivity using the entropy weighting method. The specific measurement indicators and the results are presented in Table 1:

Table 1. New Quality Productivity Measurement Framework

Factor	Sub-factor	Indicator	Indicator Calculation	Weight
Labor	Living Labor	R&D Personnel Salary Ratio	$(\text{R\&D Expenses} - \text{Salaries \& Wages}) / \text{Operating Revenue}$	28
		R&D Personnel Ratio	$\text{Number of R\&D Personnel} / \text{Total Number of Employees}$	4
		Highly Educated Personnel Ratio	$\text{Number of Employees with Bachelor's Degree or Higher} / \text{Total Number of Employees}$	3
	Materialized Labor	Fixed Assets Ratio	$\text{Fixed Assets} / \text{Total Assets}$	2
		Manufacturing Overhead Ratio	$(\text{Total Outflows} - \text{Expenditures on Goods \& Services} - \text{Employee Compensation}) / (\text{Total Outflows} - \text{Employee Compensation})$ Note: $\text{Total Outflows} = \text{Sum of Operating Cash Outflows} + \text{Fixed Assets Depreciation} + \text{Intangible Assets Amortization} + \text{Impairment Provisions}$	1
		R&D Depreciation & Amortization Ratio	$(\text{R\&D Expenses} - \text{Depreciation \& Amortization}) / \text{Operating Revenue}$	27
	Hard Technology Tools	R&D Leasing Expenses Ratio	$(\text{R\&D Expenses} - \text{Leasing Expenses}) / \text{Operating Revenue}$	2
		R&D Direct Input	$(\text{R\&D Expenses} - \text{Direct Inputs}) / \text{Operating Revenue}$	28

		Ratio	
		Intangible Assets	
		Intangible Assets / Total Assets	3
		Ratio	
		Total Asset	
		Operating Revenue / Average Total Assets	1
Soft	Turnover Ratio		
Technology	Inverse of Equity		
	Multiplier	Owners' Equity / Total Assets	1
New Quality			
Productivity			100

3.2.2. Explanatory Variable: Carbon Information Disclosure (CID)

Carbon information disclosure (CID) is measured as the logarithm of (the word frequency of "carbon information" + 1). Building upon the research of Fu et al. (2025), this study evaluates the level of corporate carbon information disclosure from multiple dimensions, including carbon strategy, advocacy, policies, concepts, low-carbon management, carbon emissions status, carbon information, low-carbon R&D investment and outcomes, and third-party evaluations. Specifically, following the approach of Dou et al. (2024), we utilize Python tools to extract core keywords such as "carbon", "low-carbon concept", "carbon dioxide", "carbon disclosure", "carbon emission rights", and "low-carbon key technologies" from listed firms' annual reports, social responsibility reports, and environmental reports. This process constructs a dataset containing expressions related to "carbon information." Subsequently, we conduct retrieval, matching, and word frequency counting based on the feature words listed in Table 2. Keywords are directionally categorized, and their frequencies are aggregated to ultimately form a comprehensive indicator system for corporate carbon information disclosure levels. Given the typical right-skewed distribution of this data, a logarithmic transformation is applied to precisely quantify the corporate carbon information disclosure level. The specific results are detailed in Table 2.

Table 2. Level of carbon disclosure

Level 1 indicators			Secondary indicators
Low-Carbon	Strategies, Advocacy,		Frequency of words related to low-carbon strategy, advocacy, policy, philosophy, low-carbon development strategies, carbon reduction initiatives, and similar concepts.
Approaches, and Concepts			
Low-Carbon Management			Frequency of words related to low-carbon management, including low-carbon management procedures, low-carbon institutions, low-carbon institution building, and the green management sector.
Carbon Emissions			Frequency of words related to carbon emissions, including carbon emission, carbon emission modes, carbon emission concentrations, carbon emission measurements, and similar terms.
Carbon Information			Frequency of words related to carbon information, including carbon disclosure, carbon accounting disclosure, carbon accounting, carbon capture, carbon emission rights assets, and similar terms.
Low-Carbon	Scientific Research		Terms related to low-carbon scientific research inputs and achievements, including low-carbon key technology, carbon capture processes, low-carbon technology upgrades, carbon dioxide treatment, and low-carbon technology innovation.
Inputs and Outcomes			
Third-Party Evaluation			Frequency of words related to third-party evaluation, including carbon audit, environmental assessment reports, EIA professional bodies, low-carbon evaluation, government low-carbon subsidies, and similar terms.

3.2.3. Control Variables

Following the research of Li and Huang (2025), the following control variables are selected: Firm size (Size, measured by total assets), Asset-liability ratio (Lev), Return on assets (ROA), Board size (Board), Proportion of independent directors (Indep), Shareholding ratio of the largest shareholder (Top1), Ownership balance (Balance), Tobin's Q (TobinQ), Institutional ownership (INST), and Management expense ratio (Mfee). The definitions of these variables are presented in Table 3.

Table 3. Variable Definitions

Variable Type	Variable Name	Symbol	Definition
Dependent Variable	New Quality Productivity	Npro	Score derived from the entropy weighting method (Table 1), multiplied by 1000.
	Carbon Information Disclosure	CID	Natural logarithm of (the sum of keyword frequencies related to "carbon information" from Table 2 + 1).
Explanatory Variable		EnvrPat	Natural logarithm of (the total number of independently applied green patents in the current year + 1).
	Green Innovation	EnvrInvPat	Natural logarithm of (the number of independently applied green invention patents in the current year + 1).
		EnvrUtyPat	Natural logarithm of (the number of independently applied green utility model patents in the current year + 1).
	Financing Constraints	KZ	Measured following the method of KZ index.
Mediating Variable	Analyst Attention	Follow	Natural logarithm of (the total number of analysts following the firm in the current year + 1).
	Environmental Info. Disclosure Quality	Eiaq	Sum of scores from two categories of corporate environmental information disclosure quality indicators.
	Impact of "Dual Carbon Goals" Policy	DC	Policy variable constructed by grouping firms based on whether they belong to heavily polluting industries and the implementation of the "Dual Carbon Goals".
	Marketization Level	Market	Measured following the method of Fan et al. (2011).
Moderating Variable	Firm Size	Size	Natural logarithm of total assets.
	Asset-Liability Ratio	Lev	Total liabilities divided by total assets at year-end.
	Return on Assets	ROA	Earnings Before Interest and Taxes (EBIT) divided by average total assets.
	Ownership Balance	Balance	Shareholding ratio of the second largest shareholder divided by the shareholding ratio of the largest shareholder.
Control Variable	Proportion of Independent Directors	Indep	Number of independent directors divided by the total number of directors.
	Board Size	Board	Natural logarithm of the number of directors on the board.

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.
Largest Shareholder's Shareholding	Top1	Number of shares held by the largest shareholder divided by the total number of shares.
Nature of Ownership	SOE	Dummy variable: 1 if the firm is a state-owned enterprise (SOE), 0 otherwise.
Big Four Auditor	Big4	Dummy variable: 1 if the firm is audited by one of the Big Four (PwC, Deloitte, KPMG, EY), 0 otherwise.
Institutional Ownership Management	INST	Total number of shares held by institutional investors divided by the total number of shares outstanding.
Expense Ratio	Mfee	Management expenses divided by operating revenue.

3.3 Model Specification

To examine the impact of carbon information disclosure (CID) levels on firms' new quality productivity (Npro), we construct the following baseline regression model (1) to test Hypothesis H1:

$$Npro_{it} = \alpha_0 + \alpha_1 CID_{it} + \alpha_2 Controls + \sum Year + \sum Industry + \varepsilon \quad (1)$$

To investigate whether changes in carbon information disclosure enhance Npro by improving green innovation, alleviating financing constraints, and increasing analyst attention, we establish the following mediation models (2), following the approach proposed by Jiang,T.(2022) for mechanism testing:

$$Median_{it} = \beta_0 + \beta_1 CID_{it} + \beta_2 Controls + \sum Year + \sum Industry + \varepsilon \quad (2)$$

To test the role of environmental information disclosure quality, the "Dual Carbon Goals," and marketization level in moderating the effect of carbon information disclosure on Npro enhancement, we construct the following moderation model (3):

$$Npro_{it} = \alpha_0 + \alpha_1 CID_{it} + \alpha_2 Moderator_{it} + \alpha_3 CID_{it} \times Moderator_{it} + \alpha_4 Controls + \sum Year + \sum Industry + \varepsilon \quad (3)$$

4. Results

4.1 Descriptive Statistics

Table 4 presents the descriptive statistics for all variables. The mean of new quality productivity (Npro) is 4.818 with a standard deviation of 4.768, indicating moderate variation across firms. Carbon information disclosure has a mean of 1.51 and a standard deviation of 1.148, suggesting relatively homogeneous levels among the firms. Green innovation metrics (EnvrPat, EnvrInvPat, EnvrUtyPat) show modest performance, with means of 0.477, 0.34, and 0.274, respectively, and considerable disparities, as indicated by the maximum values (6.848, 6.328, and 5.948) and minimum values of 0. Financing constraints (KZ) have a mean of -1.075 and a standard deviation of 2.066, reflecting consistent levels across firms. Analyst attention (Follow) has a mean of 6.56 and a standard deviation of 3.851, showing concentrated attention across the

sample.

Table 4.Descriptive statistical analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Npro	16740	4.818	4.768	.74	23.195
CID	16740	1.51	1.148	0	5.561
EnvrPat	16740	0.477	0.934	0	6.848
EnvrInvPat	16740	0.34	0.786	0	6.328
EnvrUtyPat	16740	0.274	0.663	0	5.948
KZ	16740	-1.075	2.066	-10.595	10.981
Follow	16740	6.56	3.851	2.309	14.427
Size	16740	22.709	1.362	18.641	28.644
Lev	16740	0.419	0.192	0.014	0.998
ROA	16740	0.053	0.07	-0.775	0.953
Board	16740	2.119	0.199	1.099	2.833
Indep	16740	37.818	5.67	16.67	80
Top1	16740	0.338	0.15	0.018	0.9
Balance	16740	0.381	0.283	0.002	1
TobinQ	16740	2.166	1.777	0.641	86.498
INST	16740	0.458	0.252	0	1.011
Mfee	16740	0.078	0.088	0.001	6.045

4.2 Baseline Regression

Before conducting the baseline regression, a Hausman test was performed. Its results indicated the presence of fixed effects, laying the groundwork for the subsequent regression analysis. Table 5 details the regression results of the impact of corporate carbon information disclosure (CID) on new quality productivity (Npro). When neither time nor industry fixed effects were considered, and no control variables were included, the t-statistic for carbon information disclosure was 78.996, and its estimated coefficient was positive and significant at the 1% level. After adding control variables, as shown in column (2), the t-statistic for carbon information disclosure became 75.596, and the estimated coefficient remained significantly positive. When control variables, time, and industry fixed effects were all considered, the t-statistic for carbon information disclosure was 68.617, and the estimated coefficient was still significantly positive. These results clearly demonstrate that carbon information disclosure significantly enhances firms' new quality productivity, thereby validating Hypothesis H1 of this study.

Table 5 Baseline Regression Results

VARIABLES	(1) Npro	(2) Npro	(3) Npro
CID	0.234*** (78.996)	0.228*** (75.596)	0.265*** (68.617)
Size		-0.003 (-0.902)	0.010*** (3.012)
Lev		0.121*** (5.947)	0.072*** (3.596)
ROA		0.167*** (3.515)	0.024 (0.548)

Board		0.082***	0.027
		(4.116)	(1.398)
Indep		-0.000	0.000
		(-0.187)	(0.129)
Top1		-0.006	-0.057*
		(-0.185)	(-1.924)
Balance		-0.059***	-0.055***
		(-4.294)	(-4.199)
TobinQ		-0.015***	-0.011***
		(-5.351)	(-5.149)
INST		-0.039**	-0.025*
		(-2.528)	(-1.682)
Mfee		-0.003	-0.106***
		(-0.076)	(-4.028)
_cons	0.129***	0.052	-0.149*
	(39.483)	(0.603)	(-1.783)
N	16740	16740	16740
Adj. R ²	0.3166	0.3244	0.3919
Industry	NO	NO	Yes
Year	NO	NO	Yes

Note: The numbers in parenthesis are robust standard errors, *, **, and *** in brackets represent the significance levels of 10 %, 5 %, and 1 %, respectively. The following table is the same.

4.3 Endogeneity Issues and Robustness Tests

4.3.1. Addressing Endogeneity

Corporate carbon information disclosure (CID) may enhance new quality productivity through pathways like promoting green innovation, increasing analyst attention, and alleviating financing constraints. However, bidirectional causality between CID and new quality productivity could exist. CID might improve productivity by boosting transparency and investor confidence, while productivity improvements could encourage more disclosure. To address potential endogeneity, this study employs both an Instrumental Variable (IV) approach and Propensity Score Matching (PSM). Following Shen et al. (2024), we use the mean CID of non-sample firms within the same industry as the IV. The one-period lag of CID was also tested but is used later as a robustness check. The IV's validity is confirmed through underidentification and weak instrument tests, with results indicating strong instrument validity (Kleibergen-Paap rk LM statistic = 344.30, F-statistic = 367.33, and P-val = 0.0000 for both AR and Stock-Wright LM S statistics).

(1) Heckman Test

Where Medcarbon information disclosure is a dummy variable defined based on the median of "corporate carbon information disclosure" (assigned 1 if carbon information disclosure is high), and MedCID (the instrumental variable) is the mean carbon information disclosure of firms within the same industry excluding the sample firms. Model (4) is specified as follows:

$$MedCID_{it} = \beta_0 + \beta_1 MeanCID_{it} + \beta_2 Controls + \sum Year + \sum Industry + \varepsilon \quad (4)$$

Column (1) of Table 6 presents the estimation results for the Heckman test. In the second stage, we incorporated the Inverse Mills Ratio (IMR) estimated from the first stage into the

baseline model as a control variable. The regression analysis showed that the coefficient of the inverse Mills ratio (IMR) was not significant ($p > 0.1$), indicating that sample selection bias did not systematically distort the estimation results, that is, the original model does not suffer from severe sample selection bias. Meanwhile, the coefficient of carbon information disclosure remained significantly positive at the 1% level. This implies that, even after accounting for endogeneity, carbon information disclosure (CID) still effectively enhances firms' new quality productivity, aligning with the preliminary regression results.

(2)Two-Stage Least Squares (2SLS) Test. The results of the Two-Stage Least Squares test are presented in Table 6, with column (2) displaying the second-stage results. The results show that the coefficient for corporate carbon information disclosure (CID) is positive and significant at the 1% level. This indicates that, after addressing endogeneity concerns, carbon information disclosure continues to effectively promote the enhancement of firms' new quality productivity, consistent with the baseline regression findings.

(3) Propensity Score Matching (PSM) Test. First, firms were dichotomized based on their carbon information disclosure level: those with carbon information disclosure above the median were assigned a value of 1 (MedCID=1), and those below the median were assigned 0 (MedCID=0). Subsequently, we used the control variables as matching covariates for the PSM re-estimation. Taking MedCID as the treatment variable, we sought matching samples within the group where MedCID=0. Propensity scores were calculated using a logistic regression model, and matching was performed at ratios of 1:1 and 1:4 for testing. As shown in columns (3) and (4) of Table 6, both matching methods demonstrate that carbon information disclosure significantly enhances firms' new quality productivity, thereby verifying the robustness of Hypothesis H1.

Post-PSM Analysis. As presented in Table 7, following propensity score matching, the mean new quality productivity of the treatment group (MedCID=1) remains significantly higher than that of the control group (MedCID=0). The T-statistics for the Average Treatment Effect on the Treated (ATT) are 59.75 and 66.33, respectively, both significant at the 1% level. This conclusion indicates that, even after controlling for the influence of endogeneity, carbon information disclosure retains a positive and significant effect on firms' new quality productivity.

Table 6 Endogeneity Issues

VARIABLES	IV		PSM Test	
	(1)Heckman	(2)2sls	(3)1:1	(4)1:4
CID	0.265*** (68.629)	0.126*** (4.576)	0.283*** (60.578)	0.267*** (67.593)
IMR	0.021 (0.796)			
Controls	Yes	Yes	Yes	Yes
N	16740	16740	12518	15828
Adj.R2	0.3919	0.3324	0.3617	0.3863
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes

Table 7: Average Treatment Effect of Propensity Score Matching

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
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<i>1:1</i>	Unmatched	0.715062253	0.249942174	0.465120079	0.006434779	72.28***
	ATT	0.715062253	0.7258257922	0.456804331	0.007645664	59.75***
<i>1:4</i>	Unmatched	0.715062253	0.249942174	0.465120079	0.006434779	72.28***
	ATT	0.715062253	0.255210523	0.459851729	0.006932849	66.33***

4.4.2 Additional Robustness Tests

(1) Lagged Variable. To assess the reliability of the model's conclusions, this study employed the one-period lag of the core explanatory variable, carbon information disclosure (CID). Column (1) of Table 8 presents the results of this lagged variable test. The results show that the t-statistic for Lagged CID (L.CID) is 50.362, positive and statistically significant at the 1% level. This confirms that Hypothesis H1 remains robust.

(2) Additional Control Variables. We incorporated an additional control variable into the original set: whether the auditor is one of the "Big Four" (Big4) and re-ran the regression analysis. As shown in column (2) of Table 8, the regression coefficient for carbon information disclosure remains positive and significant at the 1% level. Hypothesis H1 continues to hold.

(3) Analysis of the "Dual Carbon Goals" Impact. Using the announcement year of the "Dual Carbon Goals" (2020) as the threshold, the sample was divided into two groups, and separate regressions were performed. Columns (3) and (4) of Table 8 present the grouped regression results. The analysis reveals that the regression coefficients for carbon information disclosure in both groups are positive and significant at the 1% level. This indicates that Hypothesis H1 remains robust even after accounting for the influence of this major external policy event.

(4) Narrowing the Time Window. Adjusting the sample period helps exclude potential interference from other policies or events that might affect the findings, enhancing the relevance of the conclusions drawn from the data. By narrowing the time window and re-running the regression, column (5) of Table 8 presents the results for the adjusted period of 2019-2023. The regression results show that the coefficient for carbon information disclosure is positive and significant at the 1% level. Hypothesis H1 continues to be supported.

Table 8 Robustness Test

VARIABLES	(1) Npro	(2) Npro	(3) Npro	(4) Npro	(5) Npro
CID		0.267*** (68.100)	0.326*** (52.925)	0.224*** (46.544)	0.237*** (52.053)
L.CID	0.246*** (50.362)				
Big4		-0.040*** (-3.435)			
Controls	Yes	Yes	Yes	Yes	Yes
_cons	-0.169 (-1.601)	-0.236*** (-2.719)	-0.011 (-0.104)	-0.232* (-1.873)	-0.186* (-1.656)
N	11930	16276	8932	7808	9677
Adj.R ²	0.3479	0.3952	0.4465	0.3471	0.3622
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes

4.5 Mechanism Tests

4.5.1 Corporate Green Innovation

In constructing the corporate green innovation indicator system (EnvrPat), we followed the patent indicator methodologies established by A. Li et al. (2025). This system captures the overall landscape of green innovation patents and further subdivides it into two sub-indicators: green invention patents (EnvrInvPat) and green utility model patents (EnvrUtyPat). We utilize the annual number of applications for various types of green patents filed by listed firms to comprehensively measure their overall green innovation capability and the level of different types of innovation. After introducing the overall green innovation measure (EnvrPat) and its sub-indicators (EnvrInvPat, EnvrUtyPat) as mediating variables, the regression results displayed in Table 9 show that the coefficients for these mediating variables, CID is positive and statistically significant at the 1% level. This strongly confirms the significant mediating role of all facets of green innovation in the process through which carbon information disclosure drives new quality productivity improvement, thereby validating Hypothesis H3.

Table 9: Mechanism Test Results: Corporate Green Innovation

VARIABLES	(1) EnvrPat	(2) EnvrInvPat	(3) EnvrUtyPat	(4) KZ	(5) Follow
CID	0.046*** (5.542)	0.031*** (4.386)	0.028*** (4.639)	-0.032*** (-2.692)	0.124*** (3.974)
Controls	Yes	Yes	Yes	Yes	Yes
_cons	-3.768*** (-15.030)	-3.647*** (-15.869)	-2.046*** (-11.650)	-1.430*** (-3.811)	33.985*** (42.273)
N	16740	16740	16740	16740	16740
Adj. R ²	0.1511	0.1368	0.1273	0.6250	0.2111
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes

4.5.2 Financing Constraints

Financing Constraints (KZ). Drawing on the approach of Wang and Saqib (2025), we construct an KZ index to quantify firms' external financing constraints. A higher value of this index indicates more severe financing constraints faced by the firm. Column (4) of Table 9 shows that the t-statistic for CID is -2.692, negative and significant at the 1% level, indicating that carbon information disclosure effectively alleviates firms' financing difficulties. This demonstrates that carbon information disclosure promotes new quality productivity growth by reducing financing constraints, consistent with Hypothesis H2.

4.5.3 Analyst Attention

Analyst Attention (Follow). Following the methodologies of Ruan et al. (2024), this variable is measured as the natural logarithm of (the total number of analysts (or teams) following the firm within a year + 1). Column (5) of Table 9 shows that the t-statistic for Follow is 3.974, positive and significant at the 1% level, indicating that carbon information disclosure significantly increases analyst attention. This result supports Hypothesis H4, namely that carbon information disclosure enhances new quality productivity by increasing analyst attention.

4.6 Heterogeneity Analysis

4.6.1 Ownership Type

Ownership structure significantly impacts firms' operations and performance. In China, state-owned enterprises (SOEs) have strong ties to the government, giving them better access to policy support, financing, and emission-reduction resources, enabling effective carbon information disclosure and productivity enhancement. In contrast, non-SOEs face greater financial constraints, limiting their ability to leverage CID for productivity gains. The regression results presented in Table 10 indicate that CID exerts a significant positive effect on Npro in both the SOE and non-SOE subsamples.

4.6.2 Industry Pollution Intensity

Based on their environmental impact, industries are categorized into heavily polluting and non-heavily polluting sectors. The results in Table 10 show that CID has a significant positive effect on productivity in both heavily polluting and non-heavily polluting industries. However, the estimated coefficient is larger for heavily polluting firms, which stems primarily from stricter environmental regulations compelling them to increase green investment. Conversely, in non-heavily polluting industries, weaker regulatory pressure results in less corporate motivation to invest in emission-reduction technologies or disclose environmental information, leading to a weaker effect of CID on productivity.

4.6.3 Geographic Location

Firms are categorized into eastern and central-western groups based on their geographic location. As shown in Table 10, CID significantly enhances productivity in both groups, but its effect is stronger in the central-western region, as indicated by a larger coefficient. A possible explanation is that in the eastern region, intense market competition and a more complex industrial structure may lead stakeholders to focus more on the short-term costs associated with CID, particularly in energy-intensive sectors where it could trigger negative reactions. Moreover, stricter environmental policies in the east force firms to balance emission reduction with efficiency gains, making it more challenging to achieve synergistic effects. In contrast, firms in the central and western regions face relatively weaker market and regulatory pressures, allowing the marginal benefits of CID to become more pronounced.

Table 10 Heterogeneity Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	SOE	non-SOE	heavily polluting	non-heavily polluting	eastern	non-eastern
CID	0.312*** (40.622)	0.242*** (54.540)	0.317*** (36.138)	0.233*** (53.490)	0.253*** (56.656)	0.286*** (36.402)
N	5633	11106	4834	11906	12242	4498
Adj. R ²	0.3959	0.3881	0.3577	0.3720	0.3890	0.4013
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes

5. Further Analysis

5.1 Impact of the "Dual Carbon Goals" Policy

The "Dual Carbon Goals" policy introduced in 2020 has increased external market focus on environmental protection, raising pressure on firms. This policy has enhanced the impact of carbon information disclosure on new quality productivity. Using a Difference-in-Differences (DID) model, the study compares heavily polluting firms (treatment group) with non-heavily polluting firms (control group) in a six-year window centered around the policy's introduction. The results show that the "Dual

Carbon Goals" positively moderate the incentive effect of carbon disclosure on new quality productivity, as indicated by a significant positive coefficient for the interaction term (CID×DC) at the 5% level (Table 11, column 1).

5.2 Environmental Information Disclosure Quality

China's rapid economic growth has increased public demand for environmental quality, prompting stronger government policies on environmental protection. Corporate environmental disclosure is now both a legal requirement and a strategic necessity for firms to mitigate risks and improve competitiveness. High-quality environmental disclosure enhances corporate image, stakeholder relations, and market competitiveness. The study finds that the positive impact of carbon information disclosure on new quality productivity is significantly stronger in firms with higher environmental information disclosure quality, as indicated by a highly significant positive coefficient (1% level) for the interaction term (Table 11, column 2).

5.3 Marketization Level

Higher marketization promotes efficient resource allocation, fair competition, and innovation. Carbon information disclosure signals firms' environmental efforts, boosting market trust and recognition, which in turn facilitates access to resources and enhances new quality productivity. In regions with higher marketization, green finance policies further improve environmental performance. The study shows that the effect of carbon information disclosure on new quality productivity is stronger in regions with higher marketization, with a significant positive coefficient (1% level) for the interaction term (CID×Market) (Table 11, column 3).

Table 11 Further Analysis Results

VARIABLES	(1) Npro	(2) Npro	(3) Npro
CID	0.254*** (60.808)	0.175*** (18.533)	0.226*** (26.172)
CID×Eiaq		0.035*** (10.022)	
CID×Market			0.038*** (4.820)
CID×DC	0.026** (2.094)		
Controls	Yes	Yes	Yes
N	15450	16740	16740
Adj. R ²	0.3913	0.3976	0.3935
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes

6. Discussion, Conclusions, and Policy Recommendations

6.1 Discussion

6.1.1 Carbon Information Disclosure and New Quality Productivity

The study finds that carbon information disclosure significantly boosts the new quality productivity of A-share listed companies. This aligns with existing research showing that corporate transparency, particularly on environmental issues, fosters innovation. Carbon disclosure promotes green innovation, which in turn enhances productivity. The study also highlights that

firms with higher-quality disclosure and those in more marketized environments benefit more, supporting findings by Cumming and Nguyen (2025) on the role of marketization.

6.1.2 Mediating Effects

The positive impact of carbon information disclosure on productivity is mediated by green innovation, analyst attention, and reduced financing constraints. As carbon disclosure increases transparency, it attracts more analyst scrutiny, boosting investor confidence and facilitating innovation. It also helps firms access green financing, easing financial constraints. However, the study identifies barriers in less developed regions and heavily polluting industries, where green innovation and financing remain limited. Digital infrastructure and financial support are key to unlocking carbon disclosure's potential, particularly in these areas.

6.1.3 Heterogeneity Analysis

The impact of carbon information disclosure is stronger in state-owned enterprises (SOEs), heavily polluting industries, and regions with lower development levels. SOEs are more responsive to regulatory pressure, especially in high-pollution sectors. In contrast, the effect is weaker in developed regions with higher marketization levels, where environmental pressure is lower. Nevertheless, firms in less developed regions still see greater productivity gains, highlighting ongoing demand for green innovation in these areas.

6.1.4 Moderating Effects

The quality of environmental disclosure and the level of marketization amplify the positive effects of carbon information disclosure on productivity. Firms in environments with high-quality disclosure and greater marketization experience more significant gains. Additionally, the "Dual Carbon Goals" policy has further stimulated carbon disclosure, enhancing productivity. However, firms in less developed regions or resource-based cities face challenges in fully leveraging carbon disclosure due to insufficient financial and technological support, as noted by Tao et al. (2025).

6.2 Conclusions and Policy Recommendations

This study, based on data from A-share listed companies (2015-2023), shows that carbon information disclosure significantly enhances new quality productivity. Green innovation, analyst attention, and reduced financing constraints mediate this effect. Firms with higher environmental disclosure quality and those in more marketized environments experience greater productivity gains. The "Dual Carbon Goals" policy has further boosted carbon information disclosure (CID) and productivity. Heterogeneity analysis shows that state-owned enterprises (SOEs), heavily polluting firms, and those in central and western regions benefit the most.

Policy Recommendations:(1)**Government Policy and Regulation:**Establish a unified carbon accounting and reporting system, with clear disclosure requirements. Use big data to enhance carbon information sharing and create a centralized carbon emissions platform to improve CID and drive productivity.(2)**Corporate Green Innovation and Disclosure Strategy:**Integrate CID into green innovation strategies, establish green innovation incentive funds, and include these in performance evaluations. Improve disclosure timeliness and accuracy to attract analyst attention, reduce financing costs, and access diverse funding channels to enhance productivity.(3)**Differentiated Regulatory Approaches:**Use fiscal and tax incentives to encourage CID in non-SOEs, non-polluting firms, and those in the eastern regions. For SOEs and heavily polluting firms in central and western regions, focus on improving CID quality and investing in green innovation to boost productivity.(4)**Enhancing Environmental Information Disclosure Quality:**Companies should improve the quality of their environmental disclosures, refine

mechanisms, and strengthen audits. The government should deepen market reforms and build efficient market mechanisms. Firms should respond to the "Dual Carbon Goals," invest in R&D, and showcase achievements through CID to attract investment and boost productivity.

6.3 Limitations

The sample data for this study is confined to China's A-share listed companies, potentially limiting the generalizability of the conclusions to other countries, regions, or different types of firms, thus constraining the external validity. Although regional disparities in the impact of carbon information disclosure on new quality productivity enhancement were analyzed, exploration of variations across different industries remains relatively limited. Future research could delve deeper into the differences in carbon information disclosure and green innovation practices across various sectors, particularly how to enhance corporate ESG performance within the context of executive environmental awareness. Furthermore, given this study's primary focus on the Chinese market, future work could extend the research to other countries or regions, conducting cross-national comparative studies to analyze the role and effectiveness of carbon information disclosure under different institutional and market environments. Broadening the research scope will further validate the applicability and feasibility of carbon information disclosure's impact on firms' new quality productivity across diverse contexts.

7. Acknowledgments

Here, we sincerely thank the colleagues, institutions, and organizations that provided support and assistance throughout this research. Special thanks go to Professor Zhou for his valuable advice and guidance during the entire research process. We also appreciate the support from Chongqing Technology and Business University and the financial funding from the National Social Science Fund, which made this research possible. Without their help, this research would not have been successfully completed.

8. Funding

The authors received funding from the National Natural Science Foundation of China (Grant No. 24CJY133).

9. Conflict of interest

The authors declare no competing interests.

10. Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Title page

Can Carbon Information Disclosure Enhance Firms' New Quality Productivity? Evidence from Empirical Analysis of Chinese Listed Companies

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Cover Letter

Dear Editors:

We Wish to submit an original research paper entitled “Can Carbon Information Disclosure Enhance Firms' New Quality Productivity? Evidence from Empirical Analysis of Chinese Listed Companies” for consideration.No conflict of interest exists in the submission of this manuscript,and manuscript is approved by all authors for an significantly boost corporate new quality productivity, with green technological innovation, analyst attention, and financing constraints serving as key mediators in this process. Further research also finds that the quality of corporate environmental information disclosure, the implementation of the "dual carbon goals" policy, and the level of marketization significantly enhance the motivational impact of carbon information disclosure on new quality productivity improvement.

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We deeply appreciate your consideration of our manuscript,and we look forward to receiving comments from the reviewers.If you have any quetions,please don't hesitate to contact us at the address above.

Thank you and best regards.

Yours sincerely,

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Tang Yaoxiang, Doctor, is a Senior Accountant and Senior Engineer. He is recognized as a leading talent in accounting (enterprise category) nationwide and a leading talent in Chongqing. Tang holds multiple professional certifications, including Certified Public Accountant (CPA), Certified Tax Consultant, National Legal Professional Qualification, Chartered Internal Auditor (CIA), Chartered Institute of Management Accountants (CIMA), Certified Management Accountant (CGMA), Consulting Engineer (Investment), Supervising Engineer, Securities Practitioner, and Fund Practitioner. He has published 30 academic papers in core Chinese journals such as 'Finance and Accounting,' 'Accounting Friends,' 'Financial and Accounting Communications,' 'Construction Economics,' 'Transportation Finance,' and 'Highway Transportation Science.'