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Carbon emissions trading pilot policy drives enterprise new quality productivity: the mediating mechanism of green technology innovation

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Annotation. The promotion of global green development strategies has brought significant attention to the structural contradiction between "insufficient quality and efficiency" and "virtually high quantity" of green technology innovation, particularly concerning its role in fostering new quality productivity cultivation of enterprises. However, empirical research specifically examining the influence of a carbon emissions trading pilot policy on enterprise new quality productivity, from the dual perspective of green technology innovation, remains limited. To explore the path to promote enterprise new quality productivity, drawing upon dual theory and using the data of Chinese A-share listed companies during 2012-2023, the internal action mechanism among the carbon emissions trading pilot policy, green technology innovation, and enterprise new quality productivity was analyzed through a Difference-in-Difference method. Results show that the carbon emissions trading pilot policy generates a markedly positive influence on the enterprise's new quality productivity. In addition, the quality improvement of green technology innovation mediates this relationship. For non-state-owned, small, and high-growth enterprises, the policy exerts a stronger positive effect on new quality productivity. Furthermore, environmental attention from the government, the degree of digital transformation, and managerial performance pressure exerts positive moderating effects, whereas the degree of market competition plays a negative moderating role. These conclusions reveal the influencing mechanism of the carbon emissions trading pilot policy on enterprise new quality productivity, thereby providing a theoretical basis and practical enlightenment for economic green transformation and low-carbon, high-quality development.

Keywords: Carbon emissions trading pilot policy, quality of green technology innovation, quantity of green technology innovations, enterprise new quality productivity.

JEL classification: G38, M38, O32.

Introduction

After the signing of the *United Nations Framework Convention* on *Climate Change* in 1992, global climate governance has been gradually advancing, and agreements such as the *Kyoto Protocol* and *Paris Agreement* have been issued one after another. Particularly, the carbon emissions trading mechanism established by the *Kyoto Protocol* has been adopted by many countries globally because of its remarkable advantages in market-oriented emission reduction. However, the pressure of global emission

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reduction has not been alleviated. Previous studies have shown that despite the decelerated growth of carbon emissions in developed countries, emissions in developing countries continue to rise (de Sousa Jabbour *et al.*, 2020). China, being the largest developing country and the leading carbon emitter globally, faces significant challenges. A rapid surge in energy use during industrialization both limits economic growth and endangers ecology and public health. To promote a green energy transformation, China announced its “carbon peaking and carbon neutrality” goals in 2020. In 2025, the government work report further emphasized the development of new quality productivity driven by scientific and technological innovation. This initiative aims to explore practical pathways for global sustainable development by building a green, efficient, and intelligent modern industrial system and accelerating the low-carbon transformation of technology–industry integration.

Theoretically, the ways to improve enterprise new quality productivity have been examined in academic circles from the perspectives of productivity theory and endogenous growth theory. Productivity theory underscores that the optimal combination of production elements such as labor, capital, and technology exerts a decisive influence on output. Enterprises could adjust labor factors by recruiting technical employees, increasing capital investment in environmental protection equipment and low-carbon research and development (R&D), and introducing advanced energy-saving technologies to optimize processes (Hu *et al.*, 2023; Zhang, Liang, 2024; Lu *et al.*, 2025), improve production efficiency, and optimize resource allocation. This theory explains how factor optimization enhances productivity. Conversely, endogenous growth theory regards technological progress, knowledge accumulation, and human capital as endogenous variables for economic growth, highlighting the long-term driving effect of enterprise innovation on economic growth. The carbon emissions trading pilot policy can spur enterprises to engage in technological innovation, achieved by boosting R&D investment and setting up specialized R&D teams. In this process, enterprises not only achieved carbon emission reduction but also accumulated exclusive knowledge assets through technological breakthroughs (Liu, Xiang, 2025; Shang *et al.*, 2022). This accumulation becomes the core driving force for sustained growth, effectively answering the question of how enterprises can achieve long-term sustainable development through internal innovation under policy incentives. Based on these perspectives, the innovation spillover effect of the carbon emissions trading pilot policy (Yu *et al.,* 2023) compelled related enterprises to increase their R&D investment and low-carbon patenting. This led to some enterprises achieving transformative technological breakthroughs, consequently fostering exponential productivity growth and enhancing sustainable development performance (Wang *et al.*, 2023) and enterprise value (Jin, Wu, 2025; Xu *et al.,* 2024).

However, shortcomings are unavoidable despite the specific results achieved in discussions on how technological innovation enhances enterprise’s new quality productivity. Most studies focused solely on the overall influence of enterprises’ green technology innovation, failing to deeply explore its internal structure (Wang, Yang, 2024; Wu *et al.*, 2024). This oversight has made it difficult to clarify whether the carbon emissions trading pilot policy can fundamentally upgrade the green technology innovation of enterprises and further enhance their new quality productivity. Fortunately, dual theory provided solid theoretical support for the division of green technology innovation (March, 1991). On the basis of organizational learning, this theory divides learning behavior into adventurous exploration and selective utilization, positing that enterprises need to balance the two to achieve long-term development. Afterward, dual theory has been widely applied in the field of technological innovation. Scholars previously proposed that dual innovation needs to consider the quantity and quality of innovations (Shi, Zhang, 2024; Wang *et al.*, 2024). Studies have shown that mature green technology innovations can significantly lower corporate carbon footprints while generating sustained economic and environmental advantages, thus enhancing business sustainability (Lu *et al.*, 2023; Zhang *et al.*, 2025). Additional research revealed that the quality elevates the export product quality of enterprises in low-polluting and low-energy-consuming industries (Zhang, Qi, 2025). Moreover, the benign interaction between substantive innovation and environmental regulation proved conducive to high-quality economic development (Li, Liu, 2025; Lin *et al.*, 2021). Given these considerations, this study used dual theory to examine enterprises in areas where the carbon emissions trading pilot policy has been implemented, addressing the following questions: Can the carbon emissions trading pilot policy promote the improvement of enterprise new quality productivity? Can this policy further promote enterprise new quality productivity by improving the quality of green technology innovation? Investigating these questions not only lays a solid theoretical basis for academic discourse to deepen relevant theoretical understanding but also provides practical directional guidance and strategic reference for the government and enterprises in promoting low-carbon, high-quality development.

This study makes contributions mainly in three aspects: (1) the application scope of dual theory is further extended. While previous literature has focused solely on the general influence of carbon trading policies on enterprise green innovation (Lan *et al.*, 2024; Li *et al.*, 2024), this study analyzed the policy effect from two dimensions—innovation quality and quantity. This approach bridges a significant gap in prior literature and shows great research worth. (2) The explanatory scope of the new quality productivity theory is broadened. Different from previous studies that focused on industrial potential (Shen *et al.*, 2024) or talent elements (Zhang, 2023), the action mechanism of the carbon emissions trading policy, as a driving force of the system, was systematically demonstrated. In addition, the theoretical explanation of new quality productivity is expanded from endogenous factors to exogenous policy shocks, thereby enriching the theoretical system of high-quality development. (3) A multilevel theoretical framework integrating macro-policies, meso-industries, and micro-enterprises is constructed in this study. By systematically investigating such micro-characteristics as enterprise property rights, growth stage, and organization scale, as well as the regulatory role of external situational factors, including government environmental concern and digitalization level, this study not only expands the explanatory boundary of institutional theory in the field of enterprise management but also provides a more systematic analytical perspective for the research on sustainable development.

The remaining structure of this study is arranged as follows. Theoretical analysis and hypothesis development were presented in Section 1. Sample selection and model design were performed in Section 2. Results were analyzed and discussed in Sections 3 and 4, respectively. Finally, conclusions and implications were described in Section 5.

1. Theoretical Analysis and Hypothesis Development

1.1 Evaluating the Carbon Emissions Trading Pilot Policy's Influence on Enterprise New Quality Productivity

Drawing on the dual theory's perspective, the effect of the carbon emissions trading pilot policy on enterprise new quality productivity presents a significant dual synergy feature. Through its market-oriented mechanism, this policy urges enterprises to realize an organic unity of exploitative innovation and explorative innovation in resource allocation and strategic choices. At the level of exploitative innovation, this policy promotes enterprises to optimize existing production processes through emission constraint mechanisms. However, previous studies have shown that an overreliance on progressive improvement may lead to the "carbon lock-in" effect (Unruh, 2000), thereby limiting enterprises' ability for breakthrough innovation. On the level of exploratory innovation, studies revealed that the policy encourages enterprises to explore new energy business areas, develop green financial products, and cultivate green technology R&D capabilities (Research Group of National Institute of Development Strategy at Wuhan University, 2022). Although these breakthrough innovations may affect short-term financial performance, they are crucial for building long-term competitive advantages. Empirical evidence suggested that successful policies enable enterprises to establish a dynamic balance mechanism, allowing them to reinvest redundant resources from exploitative innovation into exploratory innovation (Feng, 2022). Furthermore, such policies provided intellectual support for technological innovation by optimizing human capital structures (Yuan *et al.*, 2023), finally achieving a substantial improvement in total factor productivity (Wang *et al.*, 2022). Effectively avoiding the limitations of a single innovation path, this binary collaborative innovation model supplies a sustainable driving force for the development of enterprise new quality productivity. Accordingly, the following hypothesis was proposed:

Hypothesis 1: The carbon emissions trading pilot policy reinforces enterprise new quality productivity.

1.2 Mediating Role of Green Technology Innovation

Existing research has typically analyzed green technology innovations through the dual theoretical lens of quantity and quality. The carbon emissions trading pilot policy, operating through market mechanisms, demonstrated synergistic effects on both innovation dimensions by combining cost internalization with revenue incentives (Ma, Zhong, 2024), and also prompted enterprises to focus on “quality innovation” of technological breakthroughs by significantly improving the quality of innovation (Shao, Sun, 2024). Generally, traditional administrative orders struggle to balance exploratory and exploitative innovation; however, scholars proposed a market-oriented carbon quota trading mechanism as a novel approach to internalizing environmental costs (Porter, Linde, 1995). By leveraging dynamically changing carbon prices as the core market signal, the resource allocation of the two innovation models can be spontaneously adjusted; prompting enterprises to pay more attention to those technological breakthroughs that can bring actual emission reduction effects (Lartey *et al.*, 2020). In the carbon market environment, enterprises that can reduce emissions through substantial innovation can gain additional benefits (Hu *et al.*, 2020), motivating them to invest more resources in exploratory innovation with high risks and high returns. Conversely, enterprises that only rely on superficial innovation face cost pressure (Zhou, Qin, 2020), thereby reducing their inefficient investment in exploitative innovation. Driven by this dual mechanism, enterprises allocate resources toward high-quality innovation that genuinely reduces carbon emissions (Dong, Chen, 2024; Gao, Wang, 2021). This fosters a paradigm shift in innovation from quantitative expansion to quality improvement, providing micro support for developing new quality productivity. Accordingly, the following hypothesis was proposed:

Hypothesis 2: The carbon emissions trading pilot policy enhances enterprise new quality productivity by improving the quality of green technology innovation.

2. Methodology

2.1 Sample and Data

Data were collected for A-share listed enterprises in China's two major stock exchanges between 2012 and 2023. During the data processing stage, several measures were implemented. First, enterprises marked as ST and *ST were excluded. Second, sample data from the financial industry were removed. Third, 1% winsorization was performed on continuous variables to mitigate the effect of extreme outliers. Finally, samples with missing variable values were excluded. Following these processing steps, a total of 18,530 enterprise–year samples were obtained. The data were mainly derived from the China Stock

Market &Accounting Research Database (CSMAR) and the Chinese Research Data Services Platform (CNRDS) databases.

2.2 Variables

2.2.1 Dependent Variable

Enterprise new quality productivity (*NQP*). Based on the existing research (Song *et al.*, 2024), new quality productivity was measured through the entropy method. Enterprise new quality productivity has been comprehensively measured through indicators spanning various dimensions, allowing for an all-encompassing evaluation of the productivity itself and its influencing factors. Specifically, this method, based on the theory of productivity factors, categorizes new quality productivity into labor and manufacturing tools, thereby constructing the new quality productivity indicator system. The labor force is further divided into living and materialized labor. Labor inputs, particularly R&D personnel, represent dynamic human capital that drives innovation and serves as a fundamental catalyst for new quality productivity. In contrast, materialized labor (e.g., fixed assets) constitutes the physical production infrastructure. Production technologies can be categorized as either: (1) hard technologies (e.g., R&D expenditures) that directly propel productivity, or (2) soft technologies (e.g., asset turnover ratios) that optimize operational efficiency and create enabling conditions (*Table 1*).

Table 1. Enterprise new quality productivity indicators

Factor	Subfactor	Indicator	Description of indicator value assignment	Weight
Labor force	Living labor	Proportion of R&D personnel salaries	R&D Expenses−Wages and salaries/Operating income	26
		Proportion of R&D personnel	Number of R&D personnel/Total number of employees	2
		Proportion of highly educated personnel	Number of personnel above an undergraduate degree/Number of employees	3
	Materialized labor (object of labor)	Proportion of fixed assets	Fixed assets/Total assets	1
		Proportion of manufacturing costs	(Subtotal of cash outflow from operating activities + Depreciation of fixed assets + Amortization of intangible assets + Impairment loss provision−Cash paid for goods and services−Wages paid to and for employees) (Subtotal of cash outflow from operating activities + Depreciation of fixed assets + Amortization of intangible assets + Impairment loss provision)	1
Production tools	Hard technology	Proportion of R&D depreciation and amortization	R&D Expenses−Depreciation and amortization/Operating income	24
		Proportion of R&D lease expenses	R&D Expenses−Lease expense/Operating income	13
		Proportion of R&D direct input	R&D Expenses−Direct input/Operating income	27
		Proportion of intangible assets	Intangible assets/Total assets	1
	Soft technology	Return on total assets	Operating income/Average total assets	1
		Reciprocal of equity multiplier	Owner's equity/Total assets	1
New quality productivity				100

Source: created by the authors.

2.2.2 Independent Variable

Carbon emissions trading policy (*did*). $did_{it} = post_t \times treat_t$. When an enterprise was part of the policy pilot area, treat was assigned a value of 1, with 0 applied in other cases. Consistent with existing research (Yao *et al.*, 2022), given that the carbon trading markets were mainly concentrated in the last half of 2013 and the first half of 2014, 2014 was set as the time when the policy took effect. *Post* is a dummy variable of time grouping. When *t* was greater than or equal to 2014, then the value of *Post* was 1.

2.2.3 Mediator Variables

Green technology innovation. The total number of green innovations (*GI*) was defined as the sum of green invention patent applications and green utility model patent applications. (Ying, 2025). The quantity of green innovations (*innovnum*) was calculated by the ratio of the sum of the number of green invention patent applications and the number of green utility model applications, as compared to the total number of patent applications (Wang *et al.*, 2024), to reflect the proportion of green technology innovation in the patent structure. In addition, the number of cited green patents was chosen to measure the quality of green technology innovation (*innovqua*) (Shi, Zhang, 2024) to embody the technical influence and actual value of innovation results. To mitigate the effect of skewed data, a value of 1 was added to the total quantity of green innovations and the numbers of cited green patents before their natural logarithms were taken.

2.2.4 Control Variables

Referring to the existing literature (Zhang, Zhang, 2025; Li, Zhu, 2025), the following variables were chosen as control variables. Profitability was measured using the return on equity (*roe*).The cashflow was expressed by the ratio of the net cashflow produced by operating activities to total assets. CEO duality (*dual*) was coded as 1 if the president and general manager were the same individual or 0 otherwise. Board size (*board*) was characterized by the number of board members. Equity concentration (*top1*) was denoted by the share proportion held by the largest shareholder. Finally, firm age (*firmage*) was calculated by taking the natural logarithm of the difference between the current year and the establishment year, plus 1.

2.3 Modeling

The following DID model was constructed to test the influence of the carbon emissions trading policy on enterprise new quality productivity:

$$NQF_{it} = \beta_0 + \beta_1 did_{it} + \beta_2 Control_{it} + \delta_i + \sigma_t + \varepsilon_{it} \quad (1)$$

Where subscripts *i* and *t* index firms and years respectively, NQF_{it} captures enterprise *i*'s new quality productivity in year *t*, and did_{it} represents the carbon emissions trading policy dummy variable; $Control_{it}$ is the set of control variables; δ_{i} represents the enterprise fixed effect, which is used to control the heterogeneous factors not varying with time from the level of enterprise individuals; σ_{t} is the time fixed effect, which aims to capture the common shocks that vary with time, such as macroeconomic environment; $\varepsilon_{\mathrm{it}}$ is a random error term; and β_1 is the regression coefficient for the core explanatory variable. If β_1 is significantly positive, then the carbon emissions trading pilot policy promotes enterprise new quality productivity.

To examine whether green technology innovation mediates the relationship between carbon emissions trading policy and firms' new quality productivity, a mediation model was constructed based on Equation (1).

$$GI_{it} = \gamma_0 + \gamma_1 did_{it} + \gamma_2 Control_{it} + \delta_i + \sigma_t + \varepsilon_{it} \tag{2}$$

$$NQP_{it} = \theta_0 + \theta_1 did_{it} + \theta_2 GI_{it} + \theta_3 Control_{it} + \delta_i + \sigma_t + \varepsilon_{it} \tag{3}$$

Where GI_{it} is the green technology innovation level of enterprise *i* in year *t*. In Equation (2), if γ_1 is significant, then the carbon emissions trading policy can promote the green technology innovation of enterprises. In Equation (3), if θ_2 is significant and the coefficient of θ_1 declines in comparison with the baseline regression model, then green technology innovation plays a partial mediating role in the influence of the carbon emissions trading policy on enterprise new quality productivity. If θ_1 is insignificant, then green technology innovation exerts a complete mediating effect.

2.4 Descriptive Statistics

Table 2 displays the descriptive statistics for all variables. The average level of enterprise new quality productivity was 4.971, ranging from a minimum of 0.624 to a maximum of 32.475, reflecting significant variations across firms.

Table 2. Descriptive statistics of main variables

Variables	Observation	Mean	Sd	Min	Median	Max
NQP	18530	4.971	2.479	0.624	4.668	32.475
did	18530	0.349	0.477	0.000	0.000	1.000
firmage	18530	2.966	0.333	0.000	2.996	3.638
cashflow	18530	0.054	0.638	-1.199	0.052	0.266
board	18530	8.681	1.699	5.000	9.000	15.000
dual	18530	0.224	0.417	0.000	0.000	1.000
top1	18530	0.342	0.150	0.076	0.321	0.758
roe	18530	0.086	0.069	-0.405	0.073	0.414

Source: created by the authors.

The explanatory variable *did* had a mean of 0.349, suggesting that approximately 34.9% of the observations belonged to the treatment group (firms subject to carbon trading policies). The remaining control variables exhibited statistical trends in line with existing literature.

2.5 Correlation analysis

Table 3 shows the test results of the Pearson correlation coefficient. Column (1) demonstrates that the estimation coefficients of the explanatory variable *did* and explained variable *NQP* were 0.066 and significant at the level of 1%.

Table 3. Correlation analysis

Variables	NQP	did	firmage	cashflow	board	dual	top1	roe
NQP	1.000							
did	0.066***	1.000						
firmage	0.045***	0.133***	1.000					
cashflow	0.125***	-0.043***	0.014*	1.000				
board	0.077***	-0.041***	0.041***	0.062***	1.000			
dual	-0.034***	0.043***	-0.088***	-0.020***	-0.174***	1.000		
top1	-0.024***	-0.024***	-0.090***	0.077***	0.053***	-0.101***	1.000	
roe	-0.018**	-0.020***	-0.010	0.388***	0.047***	-0.001	0.110***	1.000
vif		1.02	1.04	1.18	1.04	1.05	1.04	1.19

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

This result indicated that carbon trading exerts a positive driving effect on enterprise new quality productivity, preliminarily verifying H1. Apart from that, the correlation coefficient between variables was relatively low, and the maximum variance inflation factor was considerably smaller than the threshold of 10, revealing no serious collinearity between variables.

3. Results Analysis

3.1 Baseline Regression Analysis

Table 4 presents the baseline regression results of the effect of the carbon emissions trading policy on enterprise new quality productivity.

Table 4. Baseline regression results

Variables	(1)	(2)	(3)	(4)
	NQP	*NQP*	*NQP*	*NQP*
did	0.367*** (9.65)	0.121** (2.33)	0.122** (2.35)	0.113** (2.18)
firmage	0.189*** (3.45)	1.506*** (8.08)	1.500*** (8.05)	1.547*** (8.20)
cashflow	6.007*** (19.69)	0.537*** (2.70)	0.536*** (2.70)	0.815*** (3.98)
board	0.103*** (9.63)		-0.011 (-0.93)	-0.010 (-0.80)
dual	-0.136*** (-3.08)		-0.031 (-0.85)	-0.030 (-0.81)
top1	-0.495*** (-4.07)			0.201 (1.10)
roe	-2.738*** (-9.70)			-1.066*** (-5.33)
Constant	3.496*** (18.00)	0.434 (0.79)	0.555 (0.98)	0.411 (0.70)
firm	NO	YES	YES	YES
year	NO	YES	YES	YES
Observations	18,530	18,530	18,530	18,530
R-squared	0.033	0.735	0.735	0.736

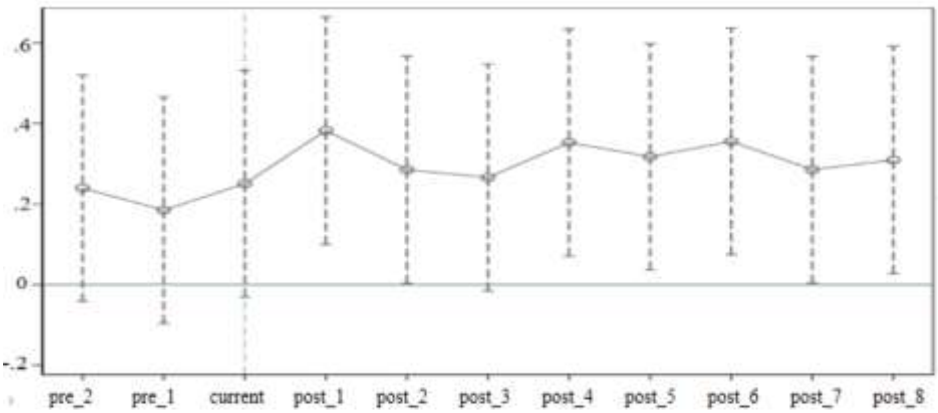
Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

In Column (1), which represents a regression model without control variables or year and individual fixed effects, the regression coefficient for the explanatory variable *did* was 0.367, statistically significant at the 1% level. This initial finding suggests that the carbon emissions trading pilot policy enhances enterprise new quality productivity. In Columns (2)–(4) of the baseline regression results, control variables were gradually introduced and year and industry effects were controlled. This approach facilitated a more comprehensive analysis of each factor's overall influence on enterprise new quality productivity. From these regression results, the *did* coefficient remained significantly positive at the 5% level, indicating that the carbon emissions trading policy markedly promotes the development of enterprise new quality productivity. Therefore, H1 was verified.

3.2 Parallel Trend Test

The DID model requires satisfaction of the parallel trend assumption for valid estimation. In this study, 2014 was used as the base period, and data from 2023 were merged with the 2022 data, mainly based on two considerations. First, during 2022 and 2023, the framework of the carbon emissions trading policy was stable, without major adjustments, and enterprises were nearly faced with the same policy environment. In addition, the microeconomic situation was stable, with similar economic growth rates and market interest rates, alongside minimal changes in technological iteration and competition pattern. This approach effectively reduced data noise. Second, given the study's focus on the mid- and short-term effects of the policy, this operation aligns with the research purpose and simplifies the analysis, thereby highlighting the comprehensive influence of the policy. The parallel trends test results are displayed in *Figure 1*.



Source: own calculations.

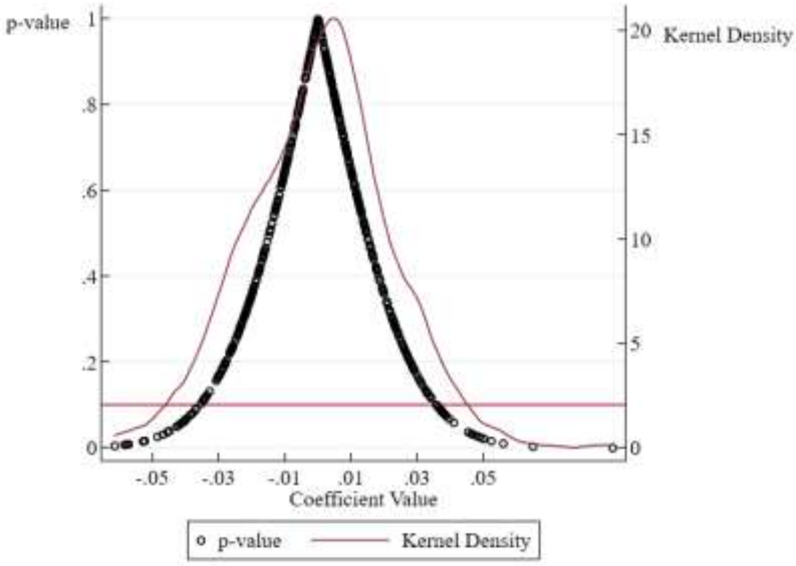
Figure 1. **Parallel Trend Test**

As shown in *Figure 1*, the confidence interval contained the zero point, and the coefficient estimation value was insignificant in all periods before the implementation of the carbon emissions trading pilot policy. This result manifests that in the early stage of policy implementation, no significant differences were found in terms of new quality productivity, the difference between the experimental group and the control group, fully satisfying the parallel trends assumption and further powerfully verifying the reliability of research conclusions.

3.3 Robustness Test

3.3.1 Placebo Test

To prevent the evaluation results from being disturbed by other unpredictable factors and exclude the occasionality of research conclusions, a placebo test was conducted by "randomly selecting the samples of the treatment group" (Lu, Li, 2024). The data of samples in the treatment group were subjected to random sampling for 500 times to establish a pseudo-treatment group, followed by repeated regression for 500 times in the pseudo-treatment group according to Equation (1). The regression results of P values and estimation coefficients were recorded and plotted as a point diagram, as shown in *Figure 2*.



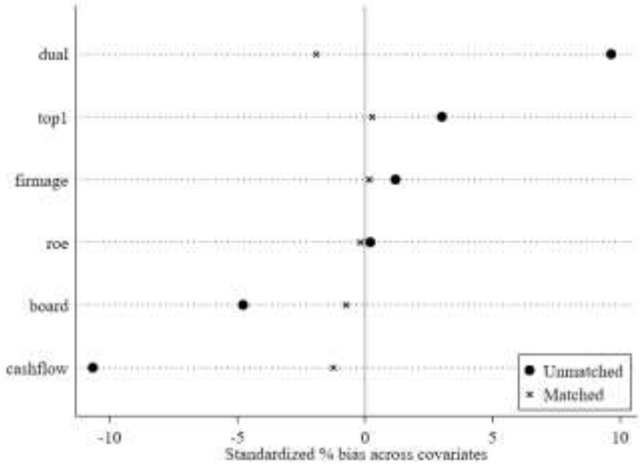
Source: created by the authors.

Figure 2. **Placebo Test**

The results show that the mean value of the estimation coefficient in the pseudo-treatment group was nearly 0, the distribution tended to be normal, and the P values of most estimation coefficients were insignificant at the 10% level. The findings confirm the policy's independent effect on enterprise productivity, supporting the robustness of our core results.

3.3.2 Propensity Score Matching (PSM)–Difference-in-Differences (DID)

PSM can alleviate some sample selection problems and avoid "selection bias" in the DID model. The specific method adopted in this study was kernel matching with profitability (*roe*), cashflow ratio (*cashflow*), CEO duality (*dual*), board size (*board*), equity concentration (*top1*), and firm age (*firmage*) as covariables. The matching results are shown in *Figure 3*. After matching, some unmatched samples were deleted for retesting using Equation (1). Column (1) of *Table 5* shows the *did* coefficient's significant positivity (5% level), confirming the policy's consistent effect after controlling for inter-group characteristic differences. This demonstrates the study's robustness against potential sample selection bias.



Source: created by the authors.

Figure 3. **Tendency Matching Results**

3.3.3 Exclusion of Data in Abnormal Years

The COVID-19 pandemic breaking out at the end of 2019 had a great effect on the macro-economy and the production activities of enterprises. Therefore, retesting was conducted after eliminating the data from 2020 to 2023, and the results are displayed in Column (2) of *Table 5*. The influence coefficient remained significant at the 1% level, proving the robustness of the baseline regression results.

3.3.4 Substitution of Explained Variables

A substitution test was performed on different explained variables. If the result is unaffected by specific measurement methods, the baseline regression results are then robust. In the economic field, productivity and production rate can often be replaced with each other. Thus, the total factor productivity was adopted to replace the explained variable to measure the new quality productivity level of enterprises. According to existing research (Ren *et al.*, 2019), regression was conducted using the total factor productivity calculated by the LP method (*TQP_LP*), by the OLS method (*TQP_OLS*), and by the GMM method (*TQP_GMM*) (Model 1).

Table 5. Robustness test

Variables	(1)	(2)	(3)	(4)	(5)
	NQP	***NQP***	***TQP_LP***	***TQP_OLS***	***TQP_GMM***
did	0.114** (2.20)	0.154*** (3.04)	0.107*** (7.86)	0.114*** (7.76)	0.071*** (5.71)
firmage	1.555*** (8.23)	2.789*** (11.20)	0.617*** (12.43)	0.775*** (14.50)	0.408*** (8.96)
cashflow	0.819*** (3.99)	0.464** (2.00)	0.249*** (4.62)	0.317*** (5.46)	0.232*** (4.68)
board	-0.009 (-0.80)	0.007 (0.50)	0.027*** (8.57)	0.035*** (10.28)	0.014*** (4.68)
dual	-0.030 (-0.81)	-0.002 (-0.04)	-0.033*** (-3.39)	-0.043*** (-4.07)	-0.028*** (-3.13)
top1	0.198 (1.08)	0.337 (1.51)	-0.035 (-0.72)	0.030 (0.58)	-0.093** (-2.09)

Table 5 (continuation). Robustness test

Variables	(1)	(2)	(3)	(4)	(5)
	NQP	*NQP*	*TQP_LP*	*TQP_OLS*	*TQP_GMM*
roe	-1.066*** (-5.32)	-1.269*** (-5.10)	2.060*** (39.14)	1.980*** (34.94)	1.997*** (41.35)
Constant	-4.563*** (-6.20)	-3.292*** (-4.41)	8.419*** (43.52)	10.451*** (50.16)	5.555*** (31.28)
Observations	18,102	12,900	18,530	18,530	18,530
R-squared	0.736	0.780	0.905	0.921	0.878
firm	YES	YES	YES	YES	YES
year	YES	YES	YES	YES	YES

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

The regression results in Columns (3)–(5) of *Table 5* show that the *did* coefficient was significantly positive at the 1% level. The analysis demonstrates that the carbon trading policy maintains its positive impact on firms' productivity even when using alternative measurement approaches.

3.4 Mediating Effect Test of Green Technology Innovation

Based on theoretical deduction, this study posits that green technology innovation is a critical path to promote the development of new quality productivity and further facilitate the high-quality development of a low-carbon economy. Columns (1) and (2) of *Table 6* show that this policy promotes the development of new quality productivity by stimulating green technology innovation in enterprises. A comparison of the regression results in the last four columns reveals that innovation quality, measured by the number of cited patents, exhibits a more prominent mediating effect than innovation quantity (an indicator of scale).

Table 6. Test of mediation effect

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	GI	*NQP*	*innovnum*	*NQP*	*innovqua*	*NQP*
did	0.822** (1.99)	0.112** (2.15)	-0.004 (-0.99)	0.113** (2.18)	0.037* (1.86)	0.102** (1.98)
GI		0.002* (1.80)				
innovnum				0.020 (0.21)		
innovqua						0.301*** (15.09)
roe	-3.707** (-2.33)	-1.059*** (-5.30)	-0.033** (-2.04)	-1.065*** (-5.32)	-0.160** (-2.08)	-1.018*** (-5.12)
firmage	-0.869 (-0.58)	1.549*** (8.21)	-0.013 (-0.82)	1.547*** (8.20)	0.304*** (4.18)	1.456*** (7.76)
top1	-1.098 (-0.75)	0.203 (1.11)	-0.013 (-0.87)	0.202 (1.10)	-0.155** (-2.20)	0.248 (1.36)
cashflow	-2.124 (-1.30)	0.819*** (3.99)	0.002 (0.12)	0.815*** (3.98)	0.041 (0.52)	0.803*** (3.94)
board	0.127 (1.34)	-0.010 (-0.82)	0.000 (0.28)	-0.010 (-0.80)	0.004 (0.97)	-0.011 (-0.92)
dual	-0.331 (-1.13)	-0.029 (-0.79)	-0.004 (-1.21)	-0.030 (-0.81)	-0.007 (-0.48)	-0.028 (-0.76)

Table 6 (*continuation*). Test of mediation effect

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	GI	*NQP*	*innovnum*	*NQP*	*innovqua*	*NQP*
Constant	4.654 (1.00)	0.403 (0.69)	0.092* (1.92)	0.410 (0.70)	-0.150 (-0.67)	0.457 (0.79)
firm	YES	YES	YES	YES	YES	YES
year	YES	YES	YES	YES	YES	YES
Observations	18,530	18,530	18,530	18,530	18,530	18,530
R-squared	0.701	0.736	0.449	0.736	0.808	0.739

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

This finding indicates that the carbon emissions trading pilot policy more significantly improves the green technology innovation quality of enterprises, whereas it's promoting effect on quantity growth is relatively weak, thereby verifying H2. This outcome likely stems from policy constraints, market competition, and reinforced supervision collectively reinforcing a "quality-oriented" innovation environment. Consequently, enterprises are inclined toward high-value, highly competitive green technology innovation projects to cater to policy requirements and market demands, finally strengthening the mediating effect of innovation quality in policy conducting routes.

3.5 Heterogeneity Analysis

In this study, from three angles of the enterprise level, the effects of the carbon emissions trading pilot policy on enterprises of different ownerships, differently sized enterprises, and enterprises with different growth trends were explored, expecting to put forward more pertinent suggestions.

3.5.1 Nature of property rights

Given that enterprises with different natures of property rights respond differently to the carbon emissions trading policy in terms of resource acquisition, policy support, decision-making mechanisms, and management modes, this study categorized the samples based on whether they were state-owned enterprises. This allowed for an exploration of the policy's influence on enterprise new quality productivity under different ownership structures. *Table 7* shows that the coefficient of did for non-SOEs is significantly positive (1% level), suggesting the policy has a stronger enhancing effect on their new quality productivity compared to state-owned enterprises. The outcome likely stems from the flexible decision-making mechanisms prevalent in non-state-owned enterprises, enabling them to respond rapidly to the pilot policy. Consequently, they can convert policy pressure into innovative impetus, actively increase investment in green innovation, and explore green business areas. Despite having weaker resource acquisition ability than state-owned enterprises, enhanced policy support allows non-state-owned enterprises to utilize limited resources more efficiently, optimize production processes, improve production efficiency, and further enhance their new quality productivity more significantly.

Table 7. The differentiation effects based on Nature of property rights heterogeneity

Variables	(1)	(2)
	state-owned	non-state-owned
did	-0.128 (-1.62)	0.330*** (4.81)
firmage	1.981*** (5.68)	0.880*** (3.71)
cashflow	1.099*** (3.58)	0.607** (2.23)
board	0.009 (0.51)	-0.025 (-1.42)
dual	-0.007 (-0.11)	-0.057 (-1.30)
top1	1.424*** (5.00)	-0.639** (-2.52)
roe	-0.621* (-1.95)	-1.571*** (-6.11)
Constant	-6.183*** (-5.18)	2.463*** (2.75)
firm	YES	YES
year	YES	YES
Observations	8,153	10,377
R-squared	0.776	0.712

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

3.5.2 Enterprise Growth Heterogeneity

Enterprise growth serves as a robust indicator of an entity's innovation capacity and willingness, along with its ability to integrate and adapt resources. In this study, the sampled enterprises were divided according to the median of the growth rate of their operating income. The enterprises exceeding this median were designated as having high growth trends, whereas those below it were considered to have low growth trends. Subsequent regression analysis, with results presented in *Table 8*, revealed a significantly positive influence coefficient for the carbon emissions trading pilot policy on the new quality productivity of enterprises with high growth trends. This finding can be attributed to the following reasons. First, high-growth enterprises are strongly willing to develop and are extremely sensitive to market opportunities. The carbon emissions trading policy promotes them to convert emission reduction pressure into the motive force of development and actively devote themselves to innovative technology R&D. Second, these enterprises possess strong resource integration ability, enabling them to rapidly allocate funds, talents, and other resources. This ensures the smooth implementation of innovative technology investments, thereby effectively enhancing their new quality productivity.

Table 8. The differentiation effects based on Enterprise growth heterogeneity

Variables	(1) High growth	(2) Low growth
did	0.265*** (3.40)	-0.077 (-1.06)
firmage	1.602*** (5.50)	1.706*** (6.39)
cashflow	0.546* (1.85)	0.901*** (2.95)
board	0.009 (0.46)	-0.039** (-2.35)
dual	-0.000 (-0.00)	0.051 (0.97)
top1	0.789*** (2.81)	-0.409 (-1.58)
roe	-1.100*** (-3.49)	-0.584** (-2.12)
Constant	-5.315*** (-5.15)	-0.660 (-0.44)
firm	YES	YES
year	YES	YES
Observations	9,265	9,265
R-squared	0.785	0.761

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

3.5.3 Heterogeneity of Enterprise Scale

Taking into account the differences in resource capacity and cost-effectiveness, as well as the different degrees of flexibility and motivation to reduce costs, will affect how enterprises of different sizes respond to policies, thus limiting the Therefore, this study further examined the heterogeneous effect of the carbon emission trading pilot policy on the new quality productivity of enterprises of different sizes. The enterprises were grouped by the median of their scale within the same industry and year; those exceeding the median were classified as large enterprises, whereas those below it were designated as small enterprises. The data in the two groups were subjected to regression, and the results are presented in *Table 9*. The *did* coefficient for the small enterprise group was significantly positive at the 1% level, indicating that the carbon emissions trading pilot policy exerts a more profoundly positive influence on small enterprises compared to large ones. The reason is that small enterprises, with their simpler and more flexible organizational architectures and shorter decision-making processes, can rapidly adjust production and adopt new technologies to align with policy requirements. ir development potential.

Table 9. The differentiation effects based on heterogeneity of enterprise scale

Variables	(1) Large-scale	(2) Small-scale
did	-0.136 (-1.60)	0.283*** (4.13)
firmage	0.951*** (3.07)	2.267*** (7.84)
cashflow	0.560** (1.98)	0.789*** (2.73)
board	-0.003 (-0.19)	-0.004 (-0.20)

Table 9 (*continuation*). The differentiation effects based on heterogeneity of enterprise scale

Variables	(1)	(2)
	Large-scale	Small-scale
dual	0.023 (0.40)	-0.078 (-1.56)
top1	-0.048 (-0.18)	-0.930*** (-3.02)
roe	-0.952*** (-3.76)	-1.486*** (-4.48)
Constant	-2.348** (-2.20)	-6.522*** (-5.59)
firm	YES	YES
year	YES	YES
Observations	9,265	9,265
R-squared	0.810	0.717

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

Furthermore, small enterprises can be easily restricted by carbon emission costs due to the limited resources, thereby intensifying their drive to reduce costs, improve efficiency, implement innovative transformations, and actively explore new modes and technologies. In addition, small enterprises are usually supported by the government with subsidies and preferential loans. These external resources facilitate their policy response, thereby enhancing the promoting effect of this policy on their new quality productivity.

3.6 Moderating Effect Test

3.6.1 Environmental awareness of local governments

The impact of the carbon emissions trading policy on firms' new quality productivity is not standalone. Its implementation depth and enterprise responsiveness are largely influenced by external environmental factors. As a key indicator for measuring the importance attached by the government to environmental issues, environmental awareness directly determines the implementation of the carbon emissions trading policy and affects the enthusiasm of enterprises for productivity innovation based on policy orientation. Based on the existing literature (Wang *et al.*, 2022), the environmental awareness indicator was established using a text analysis method. First, an environmental keyword library, covering air, water, ecology, and general management dimensions, was constructed by combining research results and policy reports. Second, government work reports in 272 cities during 2012–2023 were collected, and text processing and lexicon matching were performed via Python. The indicator was then acquired by multiplying the proportion of keyword statements by 100. *Table 10* demonstrates that the interaction term in Column (1) is statistically significant at the 1% level, suggesting that stronger local government environmental awareness enhances the policy’s positive impact on firms' new quality productivity. That is, environmental awareness plays a positive regulatory role in the relationship between the two.

3.6.2 Digital Transformation

In the transformation of the carbon emissions trading policy into enterprise new quality productivity, the digitalization ability of enterprises is a key variable that cannot be ignored. Hence, taking digital transformation as a regulatory variable is essential for comprehensively revealing the conduction mechanism of policy effect and mastering the factors driving the new kinetic energy for enterprise development. Based on the literature (Zhang, Liu, 2024; Wu *et al.*, 2021), digital transformation (*digital*) was used as a regulatory variable to screen feature words from the annual reports of enterprises using Python text mining technology. The enterprise digital transformation index was calculated by aggregating feature word frequencies. As shown in Column (2) of *Table 10*, both digital and its interaction term (*did*digital*) were significant at the 1% level, confirming digital transformation's positive moderating effect on the relationship between carbon trading policies and firm productivity enhancement.

3.6.3 Managerial Performance Pressure

Managerial decision-making and resource allocation are affected by performance pressure. When faced with performance pressure, management becomes motivated to improve performance through innovation, and the carbon emissions trading pilot policy provides an opportunity for green innovation. This study constructed the managerial performance pressure indicator (*ipe*) using the formula: (Analyst-predicted net profit−Actual net profit)/Ending total assets (Hong, Yuan, 2023). The empirical results, presented in Column (3) of *Table 10*, indicate that the carbon emissions trading policy brings green development motivation to enterprises. Concurrently, performance pressure encourages management to invest resources in green innovation projects, such as R&D and talent introduction. The policy may be taken as an opportunity to increase green innovation inputs and strengthen the promoting effect of the policy on enterprise new quality productivity.

3.6.4 Degree of Market Competition

The influence of the carbon emissions trading policy on enterprise new quality productivity is restricted by the market competition environment. Difference in the degree of market competition can change enterprises' resource allocation, cost control, and innovation investment strategies, thereby reshaping the policy's transmission path. Consistent with existing research (Zhang, Wei, 2021), the Herfindahl–Hirschman Index (*HHI*) was employed to measure the degree of market competition. The *HHI* is advantageous due to its sensitivity to relative and absolute concentration while being less affected by changes in enterprise scale distribution or the number of enterprises.

Table 10. Test of moderating effects

Variables	**(1)**	**(2)**	**(3)**	**(4)**
	NQP	***NQP***	***NQP***	***NQP***
*did*gea*	0.003*** (3.66)			
gea	-0.001 (-1.04)			
*did*digtal*		0.003*** (3.24)		
digtal		0.007*** (8.09)		
*did*ipe*			1.524*** (2.80)	
ipe			0.485 (1.37)	
*did*HHI*				-1.462*** (-3.61)
HHI				-4.662*** (-17.25)
did	0.112** (2.13)	0.054 (1.04)	0.115** (2.21)	0.054 (1.04)

Table 10 (*continuation*). Test of moderating effects

Variables	(1)	(2)	(3)	(4)
	NQP	*NQP*	*NQP*	*NQP*
firmage	1.536*** (8.14)	1.449*** (7.73)	1.535*** (8.14)	1.249*** (6.67)
cashflow	0.819*** (4.00)	0.848*** (4.17)	0.809*** (3.95)	0.898*** (4.43)
board	-0.010 (-0.83)	-0.017 (-1.43)	-0.009 (-0.72)	-0.007 (-0.63)
dual	-0.029 (-0.79)	-0.036 (-0.98)	-0.028 (-0.76)	-0.022 (-0.61)
top1	0.202 (1.10)	0.339* (1.86)	0.215 (1.17)	0.304* (1.68)
roe	-1.076*** (-5.38)	-0.999*** (-5.03)	-0.797*** (-3.69)	-0.955*** (-4.82)
Constant	0.445 (0.76)	0.726 (1.25)	0.410 (0.70)	1.244** (2.14)
firm	YES	YES	YES	YES
year	YES	YES	YES	YES
Observations	18,530	18,530	18,530	18,530
R-squared	0.736	0.740	0.736	0.741

Notes: significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. The model incorporates individual and time fixed effects, and presents t-values in parentheses.

Source: own calculations.

Consequently, a higher *HHI* value signifies a weaker market competition, whereas a lower value indicates fiercer competition. Column (4) of *Table 10* indicates that weaker market competition increasingly inhibits the carbon emissions trading pilot policy's effect on enterprise new quality productivity.

4. Discussion

First, this study addresses whether different types of environmental regulation significantly influence enterprise new quality productivity differently. New quality productivity, as a key driver of high-quality economic growth, bears a close connection to total factor productivity. Previous studies (Sheng, Zhang, 2019) have indicated that command-and-control regulation inhibits the improvement of the total factor productivity due to high emission reduction costs based on "cost compliance theory" (Gray, 1987). This study focuses on the differential effect of various types of environmental regulations, finding that the carbon emissions trading pilot policy, as a market-driven regulation, can significantly improve enterprise new quality productivity. This finding further confirms that market-driven and public participation can promote the total factor productivity of enterprises by promoting innovation (Ren et al.,2019). It also verifies the rationality of the "innovation compensation theory" (Silvia *et al.*, 2017). Relevant research reveals that market-driven environmental regulation offers enterprises more autonomy and adjustment time through the price signal of market mechanisms, which often correspond to lower emission reduction costs (Wang *et al.*, 2018). This prompts enterprises to actively explore efficient green technology solutions, which have more advantages in achieving emission reduction and improving resource allocation efficiency and new quality productivity. By contrast, command-and-control regulation relies on administrative coercion and unified standards, leading enterprises to lack the endogenous motivation for independent innovation. Consequently, offsetting compliance costs through technological upgrading poses challenges to firms and thus hinders the growth of new quality productivity.

Second, the study investigates whether the carbon emissions trading pilot policy improves the green technology innovation of enterprises. The link between environmental regulation and green technological innovation has long been a focal point in academic studies, yet theoretical divergences remain. The research results show that the carbon emissions trading pilot policy can promote the green technology innovation of enterprises, supporting the Porter hypothesis. This hypothesis suggests that reasonable environmental regulation can prompt enterprises' green technology innovation under an "innovation compensation effect", which coincides with the existing research concluding that market-driven regulation promotes enterprise innovation through market-oriented pricing mechanisms (Lü *et al.*, 2025) and enables improvements in products and processes through flexible paths (Shang *et al.*, 2022). However, when the policy lacks flexibility, enterprises are forced to invest substantial capital in compliance in a short period of time, potentially crowding out R&D funds. At the same time, because innovation returns are lagging, the "crowding out effect" has become increasingly noticeable. (Ren *et al.*, 2018; Qiao *et al.*, 2022). The existing research and analysis show that the carbon trading market in China is still in the early stage of development, where the market efficiency is significantly affected by factors such as liquidity level, carbon price stability, quota allocation mechanism, and information transparency (Zhou *et al.*, 2019), and the overall efficiency still has room for improvement.

Conclusions and Implications

Conclusions

Taking 18,530 A-share listed companies during 2012–2023 as research samples, the internal relations of the carbon emissions trading pilot policy and green technology innovation with enterprise new quality productivity were empirically discussed through a DID model and dual theory. The following conclusions were drawn: (1) the carbon emissions trading pilot policy can significantly improve enterprise new quality productivity in the pilot areas. (2) The quality of green technology innovation plays a mediating role in the promoting effect of the carbon emissions trading pilot policy on enterprise new quality productivity. (3) For non-state-owned enterprises, enterprises with high growth trends, and small enterprises, their new quality productivity is promoted more significantly by the carbon emissions trading pilot policy. In addition, the environmental awareness of local governments, the degree of digital transformation, and managerial performance pressure exert a positive regulatory effect on the relationship between this policy and new quality productivity. Conversely, the degree of market competition plays a negative regulatory role.

Managerial Implications

The aforementioned conclusions yield several practical implications.

(1) At the national governance level, more regions and industries should be gradually brought into the unified market system by expanding the pilot scope of carbon emission trading in an orderly manner. Concurrently, the regulatory mechanism should be taken as the institutional framework to build a standardized and transparent carbon emission trading environment. In this process, policymakers must fully leverage financial subsidies and tax incentives, focusing on stimulating the endogenous impetus for green technology innovation through differentiated policy designs. Especially, special support policies with high accuracy and operability must be formulated to meet the actual needs of non-state-owned enterprises, high-growth enterprises, and small enterprises. In addition, the main responsibility of local governments for environmental governance must be strengthened through the coordination mechanism between central and local governments. Moreover, the digital transformation process of enterprises should be deeply integrated with the implementation of carbon emission reduction policies, and a

virtuous circle, in which policy guidance and technology empowerment promote each other, should be promoted.

(2) At the industry governance level, the bridging effect of industry associations should be fully utilized. Industry–university–research collaboration platforms should be established to promote the transformation and application of green technology innovation results and improve the overall efficiency of the industry chain. Moreover, a system of industry self-discipline norms and standards should be built. Differentiated implementation schemes should also be formulated by combining the features of different subfields, providing definite guidance for enterprises to participate in the carbon market.

(3) As the core subjects of policy implementation, green technology innovation should be embedded into strategic planning to promote the green transformation of the production process and the ecological upgrading of products and services through independent R&D or external cooperation, realizing cost reduction, efficiency improvement, and resource optimization. In addition, enterprises should actively master the policy opportunity, actively participate in the carbon emissions trading market, and formulate appropriate strategies by combining their development characteristics. Efforts should also focus on improving operational efficiency through digital transformation and establishing differentiated competitive edges centered on new quality productivity, thereby achieving sustainable development while avoiding vicious competition.

Limitations and Future Directions

This study acknowledges several limitations. First, shortcomings exist in the sample selection process. Although A-share listed companies during 2012–2023 were taken as the research objects, high-polluting and high-tech companies were not deeply explored. High-polluting enterprises are greatly affected by the carbon emissions trading pilot policy, with urgent transformation needs, and their green technology innovation model is different from common enterprises. High-tech companies are characterized by strong innovation capabilities, fast technology iterations, and possibly unique policy action mechanisms. As the two types of enterprises were not separately verified, the applicability of the research conclusions in guiding enterprises to enhance their new quality productivity by virtue of the policy would be restricted, making it difficult to fully reveal the unique influencing path and effect of this policy. Second, weaknesses are found in the measurement of indicators. Single indicators were adopted in this study to measure enterprise quality productivity and the quality and quantity of green technology innovations. Subsequent research could address these limitations by sampling high-polluting enterprises and high-tech companies for in-depth investigation and by implementing multiple indicator tests.

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ANGLIES EMISIJŲ PREKYBOS BANDOMOJI POLITIKA IR ĮMONIŲ NAUJOS KOKYBĖS PRODUKTYVUMAS: ŽALIŲJŲ TECHNOLOGIJŲ INOVACIJŲ TARPININKAVIMO MECHANIZMAS

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Santrauka. Globalių žaliųjų plėtros strategijų skatinimas atkreipė dėmesį į struktūrinį prieštaravimą tarp „nepakankamos kokybės ir efektyvumo“ ir „didelio žaliųjų technologijų inovacijų kiekio“, ypač kalbant apie jų vaidmenį naujos kokybės produktyvumo įmonėse ugdymo aspektu. Tačiau vis dar trūksta empirinių tyrimų, kurie nagrinėtų anglies emisijų prekybos bandomosios politikos poveikį įmonių naujos kokybės produktyvumui iš dvigubos žaliųjų technologijų inovacijų perspektyvos. Siekiant išsiaiškinti, kaip skatinti įmonių naujos kokybės produktyvumą, analizuotas vidinis veikimo mechanizmas tarp anglies emisijų prekybos bandomosios politikos, žaliųjų technologijų inovacijų ir įmonių naujos kokybės produktyvumo. Remtasi dviguba teorija, naudoti 2012–2023 m. Kinijos A klasės akcijų įmonių duomenys, taikytas skirtumų skirtumo (angl. *Difference-in-Difference*) metodas. Rezultatai atskleidė, kad anglies emisijų prekybos bandomoji politika reikšmingai teigiamai veikia įmonių naujos kokybės produktyvumą. Be to, šį ryšį stiprina žaliųjų technologijų inovacijų kokybės gerinimas. Nevalstybinių, mažų ir sparčiai augančių įmonių naujos kokybės produktyvumą ši politika veikia stipriau. Vyriausybės dėmesys aplinkai, skaitmeninės transformacijos lygis ir vadovų veiklos spaudimas veikia teigiamai moderuojančiai, o rinkos konkurencijos lygis – neigiamai. Šios išvados atskleidžia anglies emisijų prekybos bandomosios politikos poveikio mechanizmą įmonių naujos kokybės produktyvumui. Taip argumentuojamas ir teorinis pagrindas, ir praktinės įžvalgos, skirtos ekonominei žaliajai transformacijai bei mažai anglies dioksido išskiriančiai aukštos kokybės plėtrai.

Reikšminiai žodžiai: anglies dioksido emisijų prekybos bandomoji politika; žaliųjų technologijų inovacijų kokybė; žaliųjų technologijų inovacijų kiekis; naujos kokybės įmonės produktyvumas.