Received: 15 October 2025 | Revised: 15 November | Accepted: 16 November 2025 | Published online: 19 November 2025

Journal of Finance and Financial Management, Volume 1, 2025
https://h-tsp.com/

Green Taxation, Green Technological Innovation, and New Productive Forces

Huijun Yang

School of Economics, Anhui University, Hefei, China

Abstract: ***Based on panel data from 30 provinces in China from 2012 to 2022, this paper explores the impact and mechanism of green taxation on the development of new productive forces. The empirical results show that green taxation significantly promotes the development of new productive forces, with the level of green technological innovation playing an intermediary role; different types of green taxes have varying degrees of impact on new productive forces.***

Keywords: Green Taxation; New Productive Forces; Green Technological Innovation; Heterogeneity.

1. Introduction

The Central Political Bureau's 11th collective study session in January 2024 pointed out: "Green development is the backdrop of high-quality development, and new productive forces are inherently green productive forces." The development of new productive forces differs from traditional economic development models; while emphasizing economic growth, it pays greater attention to ecological environmental impacts, representing comprehensive economic and environmental development. As part of environmental regulation, green taxation policies integrate the consumption and compensation of environmental resources into the economic sphere, guiding green production and consumption, and promoting the development of green productive forces. The imposition of green taxation increases traditional production costs; coupled with shifts in public consumption concepts, the competitiveness of traditional production methods declines, stimulating enterprises to strengthen technological research and development, achieve green technological progress, and gradually transition traditional productive forces toward new productive forces.

2. Theoretical Analysis and Research Hypotheses

2.1 Direct Impact of Green Taxation on New Productive Forces

Green taxation policies can alter industrial production structures and methods, prompting traditional enterprises to transform their production methods and energy structures, introduce advanced environmental protection technologies, adopt clean energy, promote the development of green emerging industries, and achieve green industrial upgrading. Based on this, the following hypothesis is proposed:

H1: Green taxation can promote the improvement of new productive forces.

2.2 Indirect Impact of Green Taxation on New Productive Forces

2.2.1 Mediating Effect: Green Technological Innovation

According to the Porter Hypothesis, green taxation generates an "innovation compensation effect." By taxing pollution emissions or resource consumption, it increases related costs, encouraging enterprises to adopt more environmentally friendly technologies and methods in production processes and product design, thereby promoting a positive cycle of technological innovation and environmental protection. Green technological innovation not only enables enterprises to meet the requirements of green taxation policies but may also spawn new production methods and products, driving technological upgrading across entire industries and serving as an important source of new productive forces. 据此, 提出以下假设:

H2: Green taxation can promote green technological innovation, thereby driving the development of new productive forces.

2.2.2 Heterogeneity Analysis of Tax Types

Each type of tax is levied for a specific purpose, and different types of green taxes may have varying impacts on the development of new productive forces. Therefore, this paper will also explore the heterogeneous effects of green taxes on new productive forces from the aspects of environmental protection, rational development and utilization of resources, and product production and consumption. Based on this, the following hypothesis is proposed:

H3: The impact of green taxes on new productive forces exhibits tax-type heterogeneity.

3. Research Design

3.1 Variable Selection and Description

3.1.1 Explained Variable: New Productive Forces

This paper refers to the method of Wang Jue (2024) and constructs a comprehensive evaluation index system from the perspective of the three elements of productive forces, as shown in Table 1. At the same time, the entropy weight method is used to determine the weights of sub-indicators, and the development level of new productive forces is measured through the comprehensive scores of different research objects.

Table 1: Comprehensive Evaluation Index System of New Productive Forces

Target Layer New Productive Forces	Criterion Layer	First-Level Indicator	Second-Level Indicator	Third-Level Indicator	Measurement Method	Attribute
	Workers		Educational Attainment	Average Educational Attainment per Capita	Average Years of Education per Capita	Positive
		Worker Skills	Human Capital Structure	Workers' Human Capital Structure	Divide the labor force's educational attainment into 5 levels and measure using vector angle	Positive
				Student Structure in Institutions of Higher Education	Proportion of College Students in Total Population	Positive
		Labor Productivity	Per Capita Output Value	Per Capita GDP	GDP/Total Population	Positive
			Per Capita Income	Per Capita Wage	Average Wage of Employed Staff and Workers	Positive

		Workers' Awareness	Employment Concept	Proportion of Employees in Tertiary Industry	Proportion of Tertiary Industry Employment in Total Employment	Positive
			Entrepreneurial Concept	Entrepreneurial Activity	Entrepreneurial Activity	Positive
	Labor Object	New-Quality Industries	Strategic Emerging Industries	Proportion of Strategic Emerging Industries	Added Value of Strategic Emerging Industries / GDP	Positive
			Future Industries	Number of Robots	Number of Robots/Total Population	Positive
				Forest Coverage Rate	Forest Coverage Rate	Positive
			Green Environmental Protection	Environmental Protection Efforts	Environmental Protection Expenditure/Government Public Fiscal Expenditure	Positive
		Ecological Environment			Sulfur Dioxide Emissions/GDP	
				Pollutant Emissions	Wastewater Discharge/GDP General Industrial Solid Waste Generation	Negative
			Pollution Reduction		Amount/GDP Industrial Wastewater Treatment Facilities (units)	
				Industrial Waste Treatment	Industrial Waste Gas Treatment Facilities (units)	Positive
					Industrial Solid Waste	
	Means of Production	Material Means of Production Intangible Means of Production	Infrastructure	Traditional Infrastructure	Highway Mileage Railway Mileage	Positive
					Fiber Optic Length	
				Digital Infrastructure	Number of Internet Broadband Access Ports per Capita	Positive
			Energy Consumption	Total Energy Consumption	Energy Consumption/GDP	Negative
				Renewable Energy Consumption	Renewable Energy Electricity Consumption/Total Social Electricity Consumption	Positive
			Technological Innovation	Number of Patents per Capita R&D Investment	Number of Patent Authorizations/Total Population R&D Expenditure/GDP	Positive Positive
			Digitalization Level	Digital Economy Enterprise Digitalization	Digital Economy Index Enterprise Digitalization Level	Positive Positive

3.2.2 Explanatory Variable: Green Taxation (GT)

This paper selects the sum of eight green taxes and fees to measure the overall level of green taxation, which are: Environmental Protection Tax (Pollution Discharge Fee), Resource Tax, Consumption Tax, Farmland Occupation Tax, Urban Land Use Tax, Urban Maintenance and Construction Tax, Vehicle Purchase Tax, and Vehicle and Vessel Tax.

3.2.3 Mediating Variable: Green Technological Innovation (GTI)

Referring to the research ideas of scholars such as Chen Xudong et al. (2024), Sun Xiaoting and Li Min (2024), the number of authorized green patents is selected to measure the level of green technological innovation.

Table 2: Variable Definitions

Variable Type	Variable Name	Symbol	Variable Definition
Explained Variable	New-Quality Productivity	NQP	Refer to Wang Jue (2024)
Core Explanatory Variable	Green Taxation	InGT	Logarithm of the sum of revenues from eight green taxes and fees
Mediating Variable	Green Technological Innovation	InGTI	Logarithm of the number of green invention patent applications
Control Variable	Economic Development Level	PGP	Logarithm of per capita GDP
	Degree of Opening Up	OPEN	Total Imports and Exports / Regional GDP
	Degree of Government Intervention	GOV	Fiscal Expenditure / Regional GDP
	Degree of Environmental Regulation	ER	Completed Investment in Industrial Pollution Control / Industrial Added Value
	Rationalization of Industrial Structure	RAT	Industrial Structure Rationalization Index (Theil Index)
	Industrialization Level	IND	Industrial Added Value / Regional GDP
	Energy Structure	ES	Regional Electricity Consumption / Total Regional Electricity Consumption

3.2 Model Specification

To investigate the impact of green taxes on new productive forces, the following two-way fixed effects model is constructed:

$$\text{NPQit} = a0 + a1\text{lnGTit} + \sum a3\text{controlsit} + \lambda i + \mu t + \varepsilon \text{ it}$$

Where NPQit is the explained variable, representing the level of new productive forces in province i in year t; ln GTit is the explanatory variable, indicating the scale of green taxes (in logarithmic form) in province i in year t ; a is the parameter to be estimated; controls it are control variables; λi and μt represent regional fixed effects and time fixed effects, respectively; and εit is the random error term.

4. Empirical Analysis

4.1 Descriptive Analysis

This paper uses Stata software for data processing and analysis, and the descriptive statistical results of the main variables are shown in Table 3. The maximum value of the explained variable is 0.509, the minimum value is 0.042, and the mean value of 0.143 has a large gap with the maximum value, indicating that there are significant differences in the level of new productive forces among provinces, and the overall level of new productive forces needs to be further improved. The maximum value of the explanatory variable is 7.810, and the minimum value is 4.085, indicating that there are significant differences in green tax revenues among different provinces.

Table 3: Descriptive Statistics of Main Variables

Variable	Sample Size	Mean	Standard Deviation	Minimum	Maximum
GT	330	6.483	0.715	4.085	7.81
NQP	330	0.143	0.071	0.042	0.509
GTI	330	7.3	1.359	3.367	10.089
PGP	330	9.332	0.464	8.598	10.806
OPEN	330	0.243	0.271	0	1.441
IND	330	0.317	0.079	0.101	0.523
GOV	330	0.249	0.102	0.107	0.643
RAT	330	0.171	0.133	0.007	0.762
ER	330	0.003	0.004	0	0.031
ES	330	0.033	0.023	0.004	0.095

URB	330	0.607	0.117	0.363	0.896
RD	330	0.017	0.011	0.002	0.065

4.2 Benchmark Regression Results

Table 4 presents the benchmark regression results of the impact of green taxes on the development level of new productive forces. Column (1) does not consider regional and time fixed effects nor include control variables; the results show that the regression coefficient of green taxes on new productive forces is 0.0981, which passes the test at the 1% significance level, meaning that each unit increase in green taxes will raise new productive forces by 0.0981 units. Columns (2)-(4) display the regression results after considering regional and time fixed effects and gradually adding control variables based on Column (1), with the conclusion remaining significantly positive. This indicates that green taxes have a positive incentive effect on the development of new productive forces to a certain extent, and Hypothesis H1 holds.

Table 4: Benchmark Regression Results

	(1)	(2)	(3)	(4)
	NQP	NQP	NQP	NQP
GT	0.0981***	0.0370***	0.0449***	0.0464***
	(0.0077)	(0.0126)	(0.0131)	(0.0132)
PGP		-0.0812***	-0.1036***	-0.1018***
OPEN		(0.0217) -0.2072*** (0.0163)	(0.0299) -0.1998*** (0.0170)	(0.0301) -0.199*** (0.0170)
IND		-0.1838*** (0.0478)	-0.2240*** (0.0502)	-0.201*** (0.0543)
GOV			-0.0906 (0.0780)	-0.0913 (0.0781)
RAT			0.0642** (0.0264)	0.0608** (0.0266)
				0.6684
ER				(0.0266)
ES				-0.0617 (0.5233)
cons	-0.4926***	1.0855***	1.2889***	1.2564***
	(0.0509)	(0.2149)	(0.3082)	(0.3103)
Time Fixed Effects	NO	YES	YES	YES
Individual Fixed Effects	NO	YES	YES	YES
Sample Size	330	330	330	330
R-2	0.3644	0.7704	0.7754	0.7764

4.3 Mediating Mechanism Test

Referring to the two-step method of mediating effect proposed by Professor Jiang Ting (2022) and the approach of Chen Xudong (2024), the logarithm of the number of green patent authorizations is used to reflect the level of green technology innovation. The results in column (2) of Table 5 show that the impact of green taxes on green technology innovation is significantly positive at the 5% level. For every 1 unit increase in green taxes, green innovation capacity increases by 0.3518 units accordingly. Green taxes enhance green technology innovation capacity, thus verifying H2, and green taxes further promote the development of new productive forces by facilitating green technology innovation.

Table 5: Mechanism Analysis

	(1)	(2)
	NQP	GTI
GT	0.0464***	0.3518**
	(0.0132)	(0.1358)
PGP	-0.1018***	0.5372*
	(0.0301)	(0.3093)
OPEN	-0.1995***	-0.0134
	(0.0170)	(0.1750)
IND	-0.2006***	0.8671

	(0.0543)	(0.5584)
GOV	-0.0913	-0.5026
	(0.0781)	(0.8029)
RAT	0.0608**	0.6738**
	(0.0266)	(0.2738)
ER	0.6684	-2.7423
	(0.5870)	(6.0365)
ES	-0.0617	5. 7800
	(0.5233)	(5.3819)
cons	1.2564***	0.2968
	(0.3103)	(3.1916)
Time Fixed Effects	YES	YES
Individual Fixed Effects	YES	YES
Sample Size	330	330
R-2	0.7764	0.8623

4.4 Heterogeneity Analysis

Drawing on the research approach of Xiao Jianle (2024), different green taxes vary in nature, purpose, and impact. Therefore, the above 8 types of green taxes are classified into three categories: environmental protection taxes (gt2), resource extraction taxes (gt3), and consumption taxes on product production (gt4). These three types of taxes are respectively substituted into the benchmark regression model, and the regression results are shown in Table 6.

The heterogeneity regression results in Table 6 show that all three types of green taxes have a positive correlation with the development of new productive forces. Both environmental protection taxes and consumption taxes on product production passed the significance test, promoting the development of new productive forces at the 1% level. Among them, environmental protection taxes have the greatest effect on new productive forces, followed by consumption taxes on product production. Finally, resource extraction taxes have the smallest and insignificant promoting effect on new productive forces. Therefore, it is necessary to consider the comprehensive impact of these taxes and comprehensively examine the impact of green taxes on new productive forces.

Table 6: Tax Type Heterogeneity

	(1)	(2)	(3)
	NQP	NQP	NQP
GT2	0.00172*** (3.13)		
GT3		0.0000197 (0.99)	
GT4			0.000116*** (9.56)
PGP	-0.0610* (0.0266)	-0.0640* (0.0301)	-0.0563* (0.0234)
OPEN	-0.1740*** (0.0165)	-0.1858*** (0.0170)	-0.1704*** (0.0145)
IND	-0.1956***	-0.1755**	-0.0718
	(0.0545)	(0.0564)	(0.0480)
GOV	-0.0264	-0.0488	-0.0379
	(0.0759)	(0.0816)	(0.0671)
RAT	0.0432	0.0481	0.0330
	(0.0264)	(0.0270)	(0.0233)
ER	0.4548	0.4924	-0.1085
	(0.5871)	(0.5963)	(0.5226)
ES	0.3265	0.0455	-0.2588
	(0.5303)	(0.5331)	(0.4647)
cons	1.0526***	1. 1111**	0.9529***
	(0.5303)	(0.3430)	(0.2648)
Time Fixed Effects	YES	YES	YES
Individual Fixed Effects	YES	YES	YES
Sample Size	330	330	330

R-2	0.7745	0.7675	0.8237

4.5 Robustness Tests

4.5.1 Excluding Abnormal Years

In the baseline regression, the selected sample period is 2012-2022. Among these years, the 2020 COVID-19 pandemic led to shutdowns and production halts in many industries, exerting a significant impact on the economy. In response to the severe economic situation, the state also introduced numerous tax relief policies. To reduce the interference of abnormal years on the research results, data from 2020 was excluded for regression. From the regression results in Table 7 (1), the impact of green taxes on new productive forces is positive and passes the 1% significance level, indicating that after excluding abnormal years, green taxes still promote the development of new productive forces, and Hypothesis H1 remains valid.

4.5.2 Introducing Lagged Variables

Considering that some green taxes are levied annually, and most enterprises only analyze their overall tax burden at the end of the year or the beginning of the next year, the impact of taxes on enterprises may have a certain lag. The green effect of taxes in the previous year may indirectly affect the next year. Referring to the approach of scholars such as Sun Shaoyan (2024), the one-period lag of green taxes was used as a lagged variable and substituted into Model (1). From the regression results shown in Table 7 (2), the coefficient of the impact of green taxes on new productive forces is significantly positive at the 5% level, verifying the stability of the positive impact of green taxes on new productive forces.

4.5.3 Adding Control Variables

An important cause of endogeneity issues is omitted variables. In Model (1), two control variables—urbanization level (URB) and R&D intensity (RD)—were added for regression analysis. Among them, the urbanization level is represented by the ratio of urban population to total population, and R&D intensity is measured by the proportion of internal R&D expenditure in GDP. After adding these two control variables, the impact of green taxes on new productive forces is significantly positive at the 1% level, and the coefficients of other control variables show little change, indicating that the baseline regression results are stable.

Table 7: Robustness Tests

	(1) Propose abnormal year NQP	(2) Introduce lagged variable NQP	(3) Add control variable NQP
GT	0.0476***	0.0307**	0.0575***
	(0.0143)	(0.0149)	(0.0138)
PGP	-0.0961**	-0.0822***	-0.1099***
	(0.0331)	(0.0315)	(0.0299)
OPEN	-0.2040***	-0.2006***	-0.1884***
	(0.0182)	(0.0195)	(0.0211)
IND	-0.2049***	-0.1994***	-0.2278***
	(0.0581)	(0.0606)	(0.0549)
GOV	-0.0842	-0.0276	-0.1206
	(0.0902)	(0.0856)	(0.0779)
RAT	0.0627*	0.0600*	0.0316
	(0.0303)	(0.0304)	(0.0283)
ER	0.5218	0.4090	0.4556
	(0.6278)	(0.6536)	(0.5867)
ES	-0.0961	-0.0996	0.1132

	(0.5804)	(0.6463)	(0.5208)
URB			-0.3052**
			(0.1292)
RD			0.7941*
			(0.4114)
cons	1.1949***	1.1294***	1.4784***
	(0.3405)	(0.3286)	(0.3182)
Time fixed effects	YES	YES	YES
Individual fixed effects	YES	YES	YES
Sample size	300	300	330
R-2	0.7749	0.9075	0.9123

4.5.4 Endogeneity Test

The conclusions drawn from the baseline regression may be affected by endogeneity issues: Enterprises with a higher level of new productive forces often have a higher level of green innovation technology and stronger environmental governance capabilities, which in turn affect the level of green taxation, thus potentially leading to endogeneity problems. Therefore, to address this issue, this paper will adopt the instrumental variable method for endogeneity testing. In terms of instrumental variable selection, the lagged 一期 (L. GT) of the explanatory variable green taxation will be used as the instrumental variable for endogeneity testing. The test results are shown in Table 8. In Table 8 (1), the coefficient of the first-stage instrumental variable (L. GT) is 0.6610 and passes the 1% significance test. The under identification test value is 145.185, and the weak instrumental variable test value is 237.262, indicating that the selected instrumental variable is exogenous and valid and not a weak instrumental variable; From the regression results in Table 8 (2), the regression coefficient of green taxation in the second stage passes the test at the 5% significance level. Therefore, after considering the endogeneity issue, the conclusion that green taxation significantly affects new productive forces still holds, indicating that the conclusions of the baseline regression are robust.

Table 8: Endogeneity Test

Variables and Statistical Parameters	First Stage GT (1)		Second Stage NQP (2)
GT			0.0464** (2.28)
L. GT	0.6610*** (15.40)		
PGP	0.5176*** (5.70)		-0.1062*** (-3.10)
OPEN IND GOV	0.1600*** (2.85) 0.5176*** (2.96) 0.9550***		-0.2080*** (-11.24) -0.2234*** (-3.93) -0.0719
RAT ER	(3.87) -0.1193 (-1.36) -4.6212** (-2.45)		(-0.86) 0.0655** (2.33) 0.6236 (1.02)
ES	-0.6478 (-0.35)		-0.0695 (-0.12)
Constant	-3.7876*** (-4.00)		1.3054*** (4.08)
Unidentifiable Test		145.185	
Weak Instrument Test		237.262	
Sample Size	300		300
R-2	0.484		0.924

5. Conclusions and Recommendations

This paper selects panel data of 30 provinces in China from 2012 to 2022 to empirically analyze the impact and mechanism of green taxes on new productive forces. The empirical results show that (1) green taxes have a significant promoting effect on new productive forces, and the results are robust. (2) Green taxes can promote the development of new productive forces by incentivizing green technological innovation. (3) Different types of green taxes all have a positive impact on new productive forces, but the degrees of impact vary.

Based on the above conclusions, the following policy implications are drawn:

First, improve the green tax system and expand the coverage of green taxes. First, it is necessary to further clarify the policy objectives of the green tax system and rationally design tax rates and collection scopes according to the policy objectives. In light of new situations and new problems, continuously improve the tax system and expand the coverage of green taxes across different industries and business scopes. For example, include newly emerging pollution sources in the scope of taxation, rationally design the intensity of collection according to the degree of pollution, and improve the precision of green tax enforcement. Second, in the green tax system, consumption taxes on product production have an obvious effect on new productive forces, which can be approached from the aspects of the collection scope, tax rates, and preferential policy design of vehicle purchase tax, consumption tax, etc. For instance, increase tax incentives for environmentally friendly products such as new energy vehicles/vessels and energy-saving vehicles/vessels to attract consumption to energy-saving and environmental protection products, thereby supporting the development of new productive forces from the consumption end; at the same time, expand the collection scope and intensity of taxes on polluting products, appropriately include environment-polluting products in the collection scope in a timely manner, increase the cost of highly polluting products, and 抑制对传统高污染产品的消费.

Second, coordinate green taxes with relevant policies to form policy synergy. Green taxes do not work alone but coordinate with relevant policies to achieve policy goals. Therefore, green taxes should be coordinated with fiscal expenditure policies, price policies, environmental policies, etc., to jointly support the development of new productive forces. The main purpose of green tax collection is to contribute to the development of green and low-carbon fields, thereby promoting the green transformation of traditional productive forces and production methods to energy-efficient ones, and supporting the development of new productive forces.

Third, support green technology R&D through multiple channels and encourage green innovation. Scientific and technological innovation is the core driving force for developing new productive forces. The government can formulate relevant policies and regulations to encourage green technology R&D. For example, establishing special green technology R&D teams to provide technical support for enterprise R&D activities and conduct regular training and guidance for relevant talents, thereby driving enterprises' enthusiasm for R&D; Financial investment in science and technology is an important means to promote scientific and technological innovation, which 致力于 green technology innovation through fiscal appropriations, tax incentives, innovation funds, and research funds. Establish incentive mechanisms to encourage the transformation of basic research results into practical applications and promote the integration of science, technology and industry; Improve the intellectual property system, strengthen technology protection, and encourage technological innovation; Provide corresponding tax incentives for enterprises engaged in clean energy use, green technology R&D and application. Effectively promote breakthroughs in basic research and key technologies, vigorously develop new energy, clean energy and energy-saving industries, break through traditional economic growth models and productivity development paths, and develop green and efficient new productive forces.

References

[1] Fan, M., Yang, P., & Li, Q. (2022). Impact of environmental regulation on green total factor productivity: A new perspective of green technological innovation. *Environmental Science and Pollution Research*, *29*(35), 53785-53800.

[2] Sun, Y., Belgacem, S. B., Khatoon, G., & Nazir, F. (2023). Impact of environmental taxation, green innovation, economic growth, and renewable energy on green total factor productivity. *Gondwana Research*.

[3] Li, C., Teng, Y., Zhou, Y., & Feng, X. (2024). Can environmental protection tax force enterprises to improve green technology innovation?. *Environmental Science and Pollution Research*, *31*(6), 9371-9391.

[4] Wang, H. (2025). The Direction and Path of Tax Policy Innovation to Promote the Development of New Quality Productive Forces. *US-China L. Rev.*, *22*, 218.

[5] Wang, Y., & Yu, L. (2021). Can the current environmental tax rate promote green technology innovation?-Evidence from China's resource-based industries. *Journal of Cleaner Production*, *278*, 123443.

[6] Meltzer, J. (2014). A carbon tax as a driver of green technology innovation and the implications for international trade. *Energy LJ*, *35*, 45.

[7] Du, K., & Li, J. (2019). Towards a green world: How do green technology innovations affect total-factor carbon productivity. *Energy Policy*, *131*, 240-250.