

# Do Green Tax Incentives Promote Corporate Pollution Reduction in China?

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**Zhou Chao<sup>1</sup>, Hong Sen<sup>2</sup>, Wang Peng<sup>3</sup> and Zhang Yanyan<sup>4</sup>**

<sup>1</sup>Zhangye City Central Sub-branch of the People's Bank of China, China.

[gssdzc@gmail.com](mailto:gssdzc@gmail.com)

<sup>2</sup>Jiangxi University of Engineering, China, [153630644@qq.com](mailto:153630644@qq.com)

<sup>3</sup>Jiangxi University of Engineering, China, [2715049901@qq.com](mailto:2715049901@qq.com)

<sup>4</sup>Nantong Export-oriented Agricultural Comprehensive Development zone, China

[2737712571@qq.com](mailto:2737712571@qq.com)

**Corresponding Author: C. Zhou**

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## Abstract

*In recent years, against the background of increasing economic downward pressure, China's environmental regulations have faced the challenge of internalizing environmental costs intertwined with business pressure. This paper attempts to construct a multi-temporal double-difference model based on the basic principles and analytical logic of microeconomics. It uses China's value-added tax (VAT) transition reforms as a natural experiment to identify the causal effect of tax incentives on firms' pollution emissions to find that VAT transition reforms can significantly reduce firms' pollution emissions. The findings suggest that green tax incentives can promote corporate pollution emission reduction and provide policy recommendations for "greening" of China's tax system.*

**Keywords:** Green taxes, Environmental governance, Economic growth, Externalities  
Cost internalization, Pollution abatement.

## **1. Introduction**

Green, low-carbon and recycling development has become an important direction for China's economic transformation and leapfrogging, and the change of economic development mode has promoted the conceptual change of environmental governance. As an important policy tool for the government to regulate the macro-economy taxation has an important incentive and guiding role in the promotion of the transformation of the mode of economic development, upgrading of the industrial structure, adjustment and optimization of the energy structure, energy-saving and environmental protection technological innovation, and the construction of a green consumption pattern. China's fiscal and taxation system adheres to the green development orientation, profoundly grasps the new situation and tasks of the new stage of development, anchors itself in the goal of sustainable economic and social development. It comprehensively embodies the green orientation in the division of powers, the design of tax types, the arrangement of expenditures, and the management of budgets, and cooperates with the administrative, market, and rule of law means to promote the construction of an ecological civilization in a concerted effort to continually satisfy the people's growing needs for a beautiful ecological environment.

In recent years, against the background of increasing downward pressure on the economy, China's environmental regulations have faced the challenge of internalizing environmental costs intertwined with the pressure on business operations. Hence the ways to deal with the current situation where environmental policy tools are too homogeneous, how to enhance the endogenous motivation of enterprises to reduce emissions have become key propositions for promoting green development. Tax incentives are among the core institutional arrangements for the government's supply-side structural reform under the market economic system and for stimulating the vitality of market players, and they have the outstanding advantages of precise targeting and easy control of regulatory efforts. In recent years, China has continued to launch a number of tax incentive policies, with the aim of fully mobilizing enterprises and releasing policy dividends precisely towards realizing the important goal of transforming the growth momentum. Will green tax incentives promote

corporate pollution reduction?

Following the introduction of environmental protection tax in China on 1 January 2018, China's "dual-carbon" target was formally proposed in September 2020, which makes the green transformation of the economy and society an inevitable pursuit of today's society, in which the transformation of the tax system forms an important part. In recent years, China has initially formed a green tax system having environmental protection tax as the main body, resource tax as the focus, and vehicle purchase tax, enterprise income tax, value-added tax, consumption tax and other taxes as supplements. When there is a negative externality of environmental pollution, the government levies environmental protection tax against polluting enterprises, which can convert the social marginal cost of pollution into the marginal cost of private enterprises. Further, it can prompt the scale of pollution emission to go down. Based on the basic principles of microeconomics and relying on theoretical and empirical studies of China's policy practices, this paper attempts to find that green tax incentives can promote corporate pollution emission reduction, puts forward policy recommendations to transform China's tax system into a "green" tax system.

The paper is structured as follows: Section 2 is the literature review, including the current status of domestic and foreign research and literature review; Section 3 is the related concepts, introducing the concepts of externality and green tax; Section 4 is the theoretical logic, illustrating the effects of green tax incentives on corporate pollution emissions with specific examples; Section 5 is the results and analysis, uses China's VAT transition reform as a natural experiment to construct a multi-temporal double difference model to identify the causal effect of tax incentives on corporate pollution emissions; Section 6 is the conclusion, which empirically finds that VAT transition reform can significantly reduce corporate pollution emissions.

## **2. Literature review**

In terms of research experience in foreign economics, the "Pigou tax" proposed by Pigou, a British welfare economist, is regarded as the prototype of environmental protection tax. Later, Pearce (1991) first proposed the concept of "double dividend" of environmental tax-- the collection of environmental tax can not only improve the quality of the ecological environment, but also reduce the distortion effect of the

existing tax, promote economic growth and increase the employment rate of the society (Pearce, 1991). Porter and Linde (1995) argued that appropriate environmental regulation will stimulate technological innovation and enhance the competitiveness of enterprises and Grossman and Krueger (1991) proposed the environmental Kuznets curve, which proved that the income distribution follows an inverted U-shaped curve with economic development.

Research on environmental regulation and economic growth is also increasing in China's domestic academic community. For example, Zhang Tongbin (2017) pointed out that there is a positive correlation between environmental regulation and economic growth and that high-intensity environmental regulation can stimulate the innovation ability of enterprises, which in turn improves the efficiency of the use of production inputs and the marginal productivity of factors. Huang Qinghuang and Gao Ming (2016) and Wang Jun and Li Ping (2018) on the other hand, argue that there is a significant inhibitory effect of green tax policy in economic growth, and there is obvious regional variability in its qualitative and quantitative effects. Some other scholars, such as Jiang Fuxin et al. (2013), believe that the economic effect depends on which one of the two effects, "innovation compensation" and "compliance cost", is dominant.

In summary, there is a wealth of academic research addressing the issue of green taxes, but the conclusions of the relevant studies have not yet been agreed upon. Then, how do tax incentives can impact on the pollution emissions of enterprises? Based on the combined microdata of China Industrial Enterprises Database and China Industrial Enterprises Pollution Emission Database from 2000 to 2012, we select the value-added tax (VAT) transition reforms from 2004 to 2009 as the policy shock, and adopt the method of multi-temporal double-difference modelling to empirically investigate the effect and internal mechanism of the VAT transition reforms on the enterprises' pollution emission

### **3. Conceptual framework**

Externalities, also known as spillovers, external influences, or outlier effects, and external economies, refer to situations in which the actions and decisions of one person or group of people harm or benefit another person or group of people.

Economic externalities are the non-marketable impacts on others and society caused by the economic activities of economic agents (including manufacturers or individuals). That is, members of society (including organizations and individuals) engaging in economic activities whose costs and consequences are not fully borne by the actor. Economic externalities are divided into positive externality and negative externality. A positive externality is an economic activity that benefits others or society incurring zero cost to the beneficiary, while a negative externality is an economic activity that harms others or society at no cost to the person causing the negative externality. In view of the inequity caused by negative externalities, they will be addressed through the fiscal instrument of green taxes.

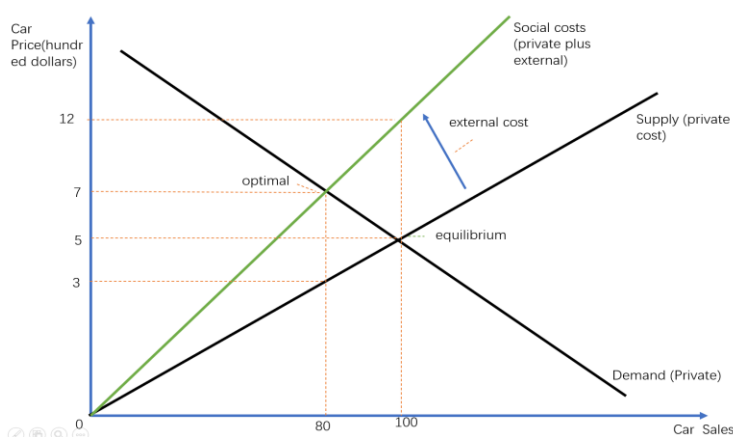
The concept of green tax originates from the theory of "Peguy tax", which advocates the use of tax means to internalize the negative externalities arising from environmental pollution, so as to optimize the allocation of resources and improve the efficiency of economic operation. With the deepening of industrialization and the increasing prominence of environmental problems, its meaning has been gradually extended from environmental protection to economic and social fields. Developed countries in the West have used this economic tool to cope with environmental problems and have gradually initiated the reform of the green tax system with good results, which has initiated global green transformation and upgrading and institutional change.

As a rising industrial country, China has an urgent need for green tax and its institutional supply based on the pressure of environmental protection and the demand of green development in the new era. Especially since the introduction of environmental protection tax, the green effect of green tax has gradually appeared, and based on the theory of double dividend, all sectors of the society are looking forward to its economic effect, so it is especially necessary to give an objective and comprehensive definition of its concept and connotation. This paper defines the concept of green tax based on a broad perspective as environmental tax, resource tax and other taxes and tax policies related to environmental protection levied on market players for the purpose of promoting environmental protection, rational development and utilization of natural resources, maintaining ecological balance and promoting

green production and consumption. In addition, it is expanded to include not only the two main green taxes--- environmental protection tax and resource tax-- but also seven green-related taxes, namely, consumption tax, arable land occupation tax, urban land use tax, vehicle and vessel tax, vehicle purchase tax, urban maintenance and construction tax, and tobacco tax.

An externality arises when a person engages in an activity that affects the welfare of bystanders and is neither paid nor remunerated for that effect. Since buyers and sellers ignore the external effects of their behaviour in determining the quantity they demand or supply, market equilibrium is not efficient in the presence of externalities. This means that the equilibrium does not maximize the total benefit to society as a whole. Assume that a car manufacturing plant emits pollutants: a certain amount of soot enters the atmosphere for every car produced. Since this soot may harm the health of those who breathe the air, it creates a negative externality. How does this externality affect the efficiency of market outcomes? Negative externalities affect the supply side, and in effect, the cost to society of producing a car is greater than the cost to the producer of the car (i.e., the producer's welfare is reduced). For each car produced, the cost to society consists of the private cost to the producer plus the cost to bystanders who are adversely affected by pollution.

**Figure 2 : Supply curve under negative externalities (Under tax)**



Source: Prepared by Author

How to achieve a socially optimal equilibrium, using taxation to internalize negative externalities arising from environmental pollution problems to optimize the allocation of resources and improve the efficiency of economic operations. A tax on aluminum factories would have the following effects.

The social deadweight loss of negative externalities is shown in the following graph: Deadweight loss to society due to externalities is USD 70 ( $DWL = (12 - 5) \times 20 \times 1/2 = 70$ ). The government intervenes to solve the problems of environmental pollution and other problems caused by negative externalities, the government levies USD 400 per vehicle on manufacturers, so that the tax also creates a DWL.

Deadweight loss due to the tax  $DWL = (7 - 3) \times 20 \times \frac{1}{2} = USD\ 40$

Total government revenue =  $4 \times 80 = USD\ 320$

The difficulty of internalizing negative externalities can be effectively solved by the fact that total fiscal revenue (USD 320) is greater than the needless loss to society (USD 70) after the tax is levied. This paper used China's VAT transition reform as a natural experiment to construct a multi-temporal double difference model to identify the causal effect of tax incentives on corporate pollution emissions.

#### **4. Results and analysis**

The study uses China's value-added tax (VAT) transition reform as a natural experiment to construct a multi-temporal double-difference model to identify the causal effects of tax incentives on firms' pollution emissions:

$$\ln(pol)_{it} = \alpha + \beta VAT_{jkt} + X_{it}\gamma + \eta_i + \theta_{jt} + \delta_{kt} + \mu_{ijkt} \quad (1)$$

Here,  $i$  stands for firm,  $j$  stands for industry,  $k$  stands for city,  $t$  stands for year,  $\alpha$  is the intercept term,  $\eta$  is the firm fixed effect,  $\theta_{jt}$  is the industry-year interaction fixed effect,  $\delta_{kt}$  is the city-year interaction fixed effect, and  $\mu_{ijkt}$  is the random error term. In Equation (1), the explanatory variable  $\ln(pol)_{it}$  represents the scale of enterprise pollution emission, which is a synthetic indicator of the six data reported in the China Enterprise Pollution Emission Database (CEPEDB): sulphur dioxide (SO<sub>2</sub>) emission, soot emission, chemical demand oxygen (CDO) emission, ammonia nitrogen (AN) emission, industrial wastewater (WW) emission,

and industrial exhaust gas (IEG) emission, the core explanatory variables. The core explanatory variable  $VAT_{jkt\_jkt}$  represents whether the city-industry where the enterprise is located implements the VAT transformation reform, and  $X_{it}$  is the control variable, including the productivity, the size of employees, the years of operation, the financing ability, and the capital intensity of the enterprise. Considering that the time interval of China's VAT transition reform is 2004-2009, in order to include more information, this paper selects the time interval of the research sample as 2000-2012 based on two large micro datasets in China--the China Industrial Enterprises Database and the China Enterprises Pollution Emission Database.

**Table 1: Benchmark model regression results**

	(1)	(2)	(3)	(4)
	$\ln(pol)$	$\ln(pol)$	$\ln(pol)$	$\ln(pol)$
<i>VAT</i>	-0.0725*** (0.0122)	-0.0425*** (0.0112)	-0.0228*** (0.0065)	-0.0228*** (0.0069)
Enterprise fixed effects	No	Yes	Yes	Yes
Year fixed effects	No	Yes	No	No
Industry $\times$ year fixed effects	No	No	Yes	Yes
City $\times$ year fixed effects	No	No	Yes	Yes
clustering level	No	No	Enterprise	City-Industry
Sample number	361381	320555	320524	320524
$R^2$	0.0648	0.3227	0.3483	0.3264

*Note: \*10 %, \*\*5 % and \*\*\*1 % significance levels, and heteroskedasticity robust standard errors in parentheses.*

We estimate the baseline model using measures that control for firm fixed effects, industry-year interaction fixed effects, and city-year interaction fixed effects, and with standard errors clustered into the city dimension. The regression results from the mixed OLS regressions, controlling for year fixed effects and firm fixed effects, and controlling for all fixed effects but with standard errors clustered into the firm dimension are reported simultaneously in Table 1. Specifically, column (1) presents the mixed OLS regression results, where it can be found that the coefficient of the double difference term of the core explanatory scalar, the VAT transition reform, is significantly negative, suggesting that the growth tax transition reform significantly reduces the scale of firms' pollution emissions. Column (2) shows the regression



results controlling for year fixed effects and firm fixed effects, and column (3) shows the regression results controlling for firm fixed effects, industry-year interaction fixed effects, and city-year interaction fixed effects, with standard error clustering to the firm dimension, and it can be found that the coefficients of the core explanatory variables are still significantly negative and the size of the coefficients does not change much compared with the mixed OLS regression results. Column (4) presents the regression results controlling for all fixed effects while standard errors are clustered to the city-industry dimension, which shows that the double-differenced coefficient of VAT reform remains significantly negative, and this result passes the one per cent significance test. Column (4) is used as a more accurate estimate of the baseline model. The estimation results show that, other factors being unchanged, after the implementation of the VAT reduction reform policy, the scale of corporate pollution emissions is significantly reduced by 2.28 per cent, i.e., tax incentives can effectively promote corporate pollution reduction.

Further, this paper examines whether the trend of change in the treatment and control groups before the implementation of the VAT reform is consistent to ensure that the assumption of parallel trends in the application of multi-temporal double-difference estimation is valid, and as a result, the measurement equation is set as follows:

$$\ln(pol)_{it} = \alpha + \beta_n \sum_{n=-3}^4 VAT_{jk,policy+n} + X_{it}\gamma + \eta_i + \theta_{jt} + \delta_{kt} + \mu_{ijkt} \quad (2)$$

Where,  $VAT_{jk,policy+n}$  is the policy implementation window, taking 1 for the year of policy implementation and 0 for other years. This paper tests the dynamic trend change of each firm from 3 years before to four years after the implementation of the VAT reduction reform policy, using one year before the implementation of the policy as the base period, and closing both ends for observers outside the window period. The regression results show that during the policy window period, when the growth tax transition reform is implemented before, all regression results are insignificant<sup>1</sup>, indicating that there is no significant difference in the trend of pollution emissions between the treatment and control groups. When the VAT reform was implemented, all coefficient regression results were significantly negative, indicating that pollution

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<sup>1</sup> Therefore, results were not presented.

emissions from firms in the treatment group were significantly lower compared to the control group, satisfying the parallel trend hypothesis.

## **6. Conclusion**

Based on the principles of microeconomics and the theoretical knowledge, it can be argued that: tax incentives can achieve an effective balance between economic development and environmental protection by promoting green innovation and cleaner production by enterprises, and by reducing pollutant emissions without compromising the scaling up of enterprises. Meanwhile, based on the combined micro-data of China's industrial enterprise database and China's industrial enterprise pollution emission database from 2000 to 2012, the VAT transition reform from 2004 to 2009 is selected as the policy shock, and the multi-temporal double difference model method is used to empirically study the impact effect and internal mechanism of the VAT transition reform on the pollution emission of the enterprises. The empirical results of this paper find that the VAT transition reform can significantly reduce the pollution emissions of enterprises. The results of this paper show that VAT reform can significantly reduce the pollution emission of enterprises. This provides useful insights from the reform of fiscal and taxation policies for China for the construction of institutions and mechanisms to achieve the goal of coordinating the construction of ecological civilization and the coordinated development of economy and society under the new development pattern.

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