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Research on the Effects of Environmental Policies on Enterprise Transformation and Green Taxation: A Case Study of Local Governments in 31 Provinces of China

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Abstract: China's economic development is at a unique stage of new-type transformation, with increasing demands for the quality of economic development. Environmental fiscal and tax policies are widely recognized as crucial tools for promoting enterprise transformation and green taxation. The 20th National Congress of the Communist Party of China proposed to "improve the fiscal, financial, investment, price policies, and standards that support green development." Fiscal policy is the foundation and important pillar of national governance, and the fiscal and tax system is a critical support and basic means to promote green and low-carbon development. This paper analyzes cross-sectional data from 31 provinces, autonomous regions, and municipalities in China for the year 2022. By constructing and testing an OLS regression model, the study uses the environmental tax as a representative of the tax regulation for green development of enterprises, analyzing its influencing factors and effects. The paper provides relevant suggestions for enterprise green transformation and tax avoidance based on literature review and model results.

Keywords: Green fiscal and tax policy, Environmental tax, Enterprise green transformation, Tax effect

1. Introduction

As the quality of economic development improves, China has entered a stage of high-quality development characterized by accelerated greening and low-carbonization. Green fiscal and tax policies aim to facilitate enterprise green transformation, while tax behavior reflects enterprises' willingness for green transformation and the direction of policy guidance. Enterprise transformation and tax mechanisms are reflected in two aspects: First, green fiscal and tax policies offer transformational incentives. Enterprises can receive government credit guarantees, reducing financing constraints and costs. Simultaneously, government fiscal subsidies provide enterprises with sufficient funds, enhancing cash flow effects and willingness to transform, increasing R&D expenditure to gain excess profits in industry competition. The tax relationship is eased, promoting standard tax behavior and exerting a suppressive effect on taxation. Additionally, green fiscal and tax policies increase environmental regulation. Under mandatory local reform policies, the costs of enterprise management, financing, and administration rise, forcing enterprises to upgrade and

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transform. Enterprises may use various tax avoidance methods to fit the policy scope, transferring institutional and operational costs, thereby incentivizing tax avoidance behavior and resulting in lower environmental taxes. Therefore, the mechanism of fiscal policy-transformation-tax avoidance can comprehensively explore the impact of green fiscal policies on enterprise transformation and tax avoidance trends.

2. Literature Review

Research on the conceptual framework of green fiscal and tax policies primarily includes policy objectives, tool classification, and system construction status. From an economic perspective, green fiscal and tax policies correct the inability to internalize the positive externalities of green investments or the negative externalities of pollution investments under the market price system [1]. Based on the issuing department and type of green fiscal policies, they are generally divided into three categories: green credit policies, green insurance policies, and green securities policies.

Studies on the implementation of green fiscal policies by local governments indicate that market profit-seeking behavior leads to a series of problems, necessitating the role of government. From a policy structure perspective, government actions can be broken down into economic means such as fiscal grants, tax incentives, and guarantees, as well as administrative and legal means of investment production constraints [2].

Research on the intervention of green fiscal policies in enterprise transformation focuses on financing, taxation, and administrative measures. Financially, it is manifested through tax policies and policy protection. Taxing high-polluting enterprises transfers their income to the government, and taxing raw materials of high-polluting enterprises through substitution effects can control resources [3].

Studies on enterprise tax behavior from the enterprise perspective mainly cover tax avoidance motivations and methods. On the incentive side, green fiscal policies stimulate enterprise R&D innovation, contributing to tax avoidance motivations [4]. On the inhibitory side, green fiscal policies enhance the development prospects of supported industries, improve enterprise performance, increase government subsidies and bank loans, reduce financing constraints, and inhibit tax avoidance motivations. Reducing financing costs for green enterprises will better enhance their green innovation, while imposing financing pressures on brown enterprises, forcing them to green transformation and guiding resources from heavily polluting enterprises to non-polluting ones [5], thus reinforcing the "innovation compensation effect" of environmental regulations and compelling heavily polluting enterprises to transform [6].

3. Research Design

3.1. Sample Selection

Data were collected from 31 major provinces and municipalities in China, sourced from the 2022 China Statistical Yearbook. The selection includes the total environmental tax for 2021, the total general public budget expenditure on energy conservation and environmental protection, completed investment in industrial pollution control, and the number of new product development projects in industrial enterprises for each province.

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Table 1: Data Collection

Region	Environmental Tax Y (billion yuan)	Energy Conservation and Environmental Protection Expenditure X1 (billion yuan)	Completed Investment in Industrial Pollution Control X2 (ten thousand yuan)	Number of New Product Development Projects X3
Beijing	9.44	236.9	5122	13188
Tianjin	3.12	60.72	74511	14449
Hebei	24.49	509.27	129336	20229
Shanxi	12.6	260.28	284910	6539
Inner Mongolia	19.76	149.37	154407	2527
Liaoning	5.95	97.94	98020	14329
Jilin	1.48	131.53	8063	3741
Heilongjiang	2.27	220.27	40805	4501
Shanghai	1.95	181.88	90711	22755
Jiangsu	35.24	336.9	531335	102826
Zhejiang	3.35	220.59	505097	133346
Anhui	3.22	190.83	243546	32863
Fujian	3.14	156.42	175766	27029
Jiangxi	3.51	218.27	93009	23138
Shandong	13.41	291.54	519487	59946
Henan	9.04	272.63	144548	22244
Hubei	5.84	219.18	198108	20290
Hunan	4.17	245.58	33508	26253
Guangdong	6.29	517.76	235470	166140
Guangxi	4.19	100.74	35534	6502
Hainan	0.83	57.84	476	1018
Chongqing	2.71	179.71	40176	16907
Sichuan	5.86	264.02	244414	22133
Guizhou	5.94	146.15	154911	4993
Yunnan	5.88	163.97	142339	5532
Tibet	0.2	48.93	2094	52
Shaanxi	4.14	190.34	194957	9810
Gansu	2.26	114.03	33844	1565
Qinghai	0.82	73.51	2897	308
Ningxia	1.57	49.48	60458	1777
Xinjiang	4.38	82.59	64729	1195

3.2. Model Specification

$$Y = \beta_0 + \beta_1 \times X1 + \beta_2 \times X2 + \beta_3 \times X3 \ + +\varepsilon i$$

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3.3. Model Specification

Y is the explained variable (environmental tax). This study explores the impact of X1 (energy conservation and environmental protection expenditure), X2 (completed investment in industrial pollution control), and X3 (number of new product development projects) on Y. X1 represents the national green fiscal policy, primarily through government fiscal support for enterprises. X2 explains the self-regulation of enterprises in avoiding environmental taxes. X3 measures regional innovation under green fiscal policies through the number of new product development projects.

4. Model Estimation

4.1. Model Analysis Hypotheses

H0：The explanatory variables have no significant impact on the explained variable.
H1：The explanatory variables have a significant impact on the explained variable.

4.2. Baseline Regression

Using Eviews for preliminary regression analysis, the results are as follows:

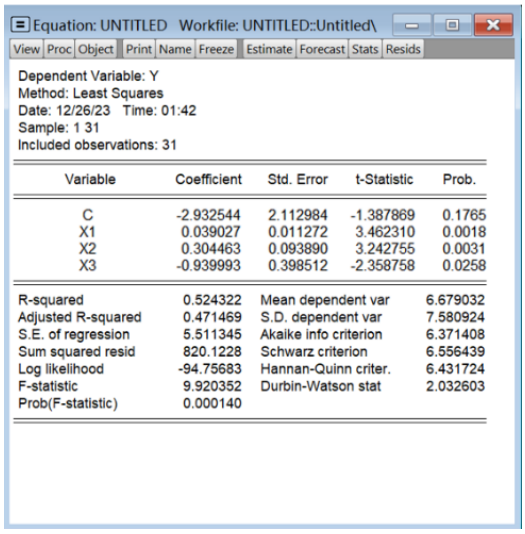

Figure 1: Baseline Regression Results

The analysis indicates that the p-values for X1, X2, and X3 are 0.0018, 0.0031, and 0.0258, respectively, all less than 0.05, rejecting the null hypothesis H0. At a 5% significance level, X1, X2, and X3 significantly affect the explained variable. The coefficient for X1 is 0.039027, indicating that for every 1 billion yuan increase in general public budget expenditure, environmental tax revenue increases by an average of 0.039027 billion yuan. The coefficient for X2 is approximately 0.304463, indicating that for every 10,000 yuan increase in completed investment in industrial pollution control, environmental tax increases by an average of 0.304 billion yuan. The coefficient for X3 is -0.939993, indicating that for every additional industrial innovation R&D project, environmental tax decreases by 0.939993 billion yuan.

4.3. Preliminary Analysis of Regression Results

The parameter estimate for X1 suggests that when national fiscal investment increases, it indicates that the local environmental situation is relatively poor, requiring substantial funding for governance.

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The environmental governance process takes time, and the effect reflected through environmental tax revenue is delayed. Therefore, the increase in current investment does not reflect the current results but only the current environmental status. The positive correlation between investment and environmental tax preliminarily validates Hypothesis 1, showing a positive relationship between public budget expenditure on energy conservation and environmental tax. The parameter estimate for X2 indicates that the completed investment in industrial pollution control and environmental tax are still positively correlated, showing a lag effect. However, the larger coefficient compared to the public budget expenditure on energy conservation suggests strong enterprise enthusiasm for environmental governance. Fiscal and tax policies significantly incentivize and compel enterprise transformation. The parameter estimate for X3 indicates that as enterprise innovation capability improves, enterprises will benefit from more tax incentives and policy support, thereby reducing environmental tax. Enterprise innovation drives enterprise transformation, creating a crowding-out effect on high-polluting enterprises. The larger parameter estimate for X3 indicates a stronger impact.

The adjusted R^2 value of 0.471469 indicates a relatively good fit. The F-test p-value of 0.00014 < 0.05 indicates that X1, X2, and X3 have a significant combined effect on Y, with a high overall explanatory level for Y.

5. Model Testing

5.1. Correlation Test

The correlation test produces a correlation coefficient table for Y with X1, X2, and X3, showing strong correlations, especially the most significant impact of X1 on Y. This indicates that energy conservation and environmental protection investment regions are accelerating environmental issue resolution, and the policy impact is noticeable. The strong correlations between X3 with X1 and X2 suggest that energy conservation investment and enterprise pollution control investment significantly affect enterprise innovation capabilities, indicating reasonable variable selection.

Table 2: Correlation Coefficient Table

	Y	X1	X2	X3
Y	1	0.5759	0.5479	0.2938
X1	0.5759	1	0.4841	0.6265
X2	0.5479	0.4841	1	0.6867
X3	0.2938	0.6265	0.6867	1

5.2. Multicollinearity Test

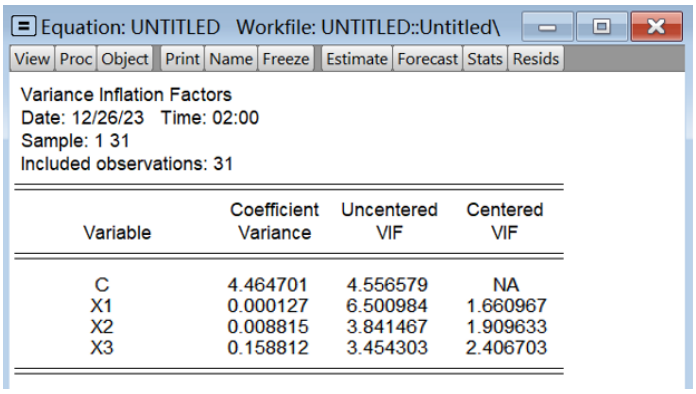

Figure 2: Variance Inflation Factor (VIF) Test Results

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The VIFs obtained through the test are 1.660967, 1.909633, and 2.406703, all of which are less than 10. This indicates that there is no multicollinearity in the model, and the model setup is relatively reasonable.

5.3. Heteroscedasticity Test

An auxiliary regression model was established based on the variables as follows:

$$e_i^2 = a_0 + a_1 \times X_{1i} + a_2 \times X_{2i} + a_3 \times X_{3i} + a4 \times X_{1i}^2 + a_5 \times X_{2i}^2 + a_6 \times X_{3i}^2 + a_7 X_{1i} X_{2i} + a_8 X_{1i} X_{3i} + a_9 X_{2i} X_{3i} + a_{10} X_{1i} X_{2i} X_{3i} + Vi$$

Model Assumption: H0: There is no significant relationship between the explanatory variable Xi and the residuals e, i.e., $\alpha 1 = \alpha 2 = \alpha 3 = \cdots \ldots = \alpha i = 0$

The White test was conducted on the auxiliary regression model, and the results are shown below:

Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Heteroskedasticity Test: White

F-statistic	7.365998	Prob. F(9,21)	0.0001
Obs*R-squared	23.54244	Prob. Chi-Square(9)	0.0051
Scaled explained SS	52.38126	Prob. Chi-Square(9)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/26/23 Time: 02:06
Sample: 1 31
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.11211	27.13423	-0.446377	0.6599
X1^2	-0.001176	0.000567	-2.072861	0.0507
X1*X2	0.002208	0.022313	0.098964	0.9221
X1*X3	0.189466	0.066693	2.840864	0.0098
X1	0.413389	0.286583	1.442473	0.1639
X2^2	-0.276776	0.078160	-3.541163	0.0019
X2*X3	2.456531	0.496046	4.952220	0.0001
X2	4.661849	3.950637	1.180025	0.2512
X3^2	-4.944678	1.357519	-3.642437	0.0015
X3	-65.35324	21.07671	-3.100732	0.0054

R-squared	0.759434	Mean dependent var	26.45557
Adjusted R-squared	0.656334	S.D. dependent var	65.13473
S.E. of regression	38.18397	Akaike info criterion	10.37841
Sum squared resid	30618.32	Schwarz criterion	10.84098
Log likelihood	-150.8653	Hannan-Quinn criter.	10.52919
F-statistic	7.365998	Durbin-Watson stat	1.148224
Prob(F-statistic)	0.000084		

Figure 3: White Test Results

With a total of 31 samples and 3 explanatory variables, the degrees of freedom is 26. From the table lookup, the chi-square critical value for 26 degrees of freedom at the 0.05 significance level is 40.113. As shown in the figure, nR^2=23.5424<40.113 indicating that the null hypothesis cannot be rejected. Therefore, the model setup does not have heteroscedasticity. The model does not suffer from heteroscedasticity due to temporal changes and scope expansion caused by cross-sectional data.

From the figure, it can be seen that the lag period is very short, indicating the absence of lag effects. Thus, there is no need for further correction of the model.

6. Conclusions and Suggestions

This paper analyzes the environmental tax in 31 provinces and municipalities in China for the year 2021 and concludes that green policies are positively correlated with fiscal general public budget expenditures on energy conservation and environmental protection and environmental tax revenue. Under the backdrop of green fiscal and taxation policies, enterprises have become more proactive in addressing industrial pollution, and environmental tax plays an incentivizing role in regional

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environmental governance. However, there is a negative correlation between regional innovation and regional environmental tax revenue under green fiscal and taxation policies.

6.1. Focus on Long-term Performance and Increase Policy Inclination

China is currently in a difficult period of enterprise transformation. From the central to local governments, more funds are being allocated towards enterprise transformation and environmental protection in the budgeting process. However, due to the lag effect of policies and reforms, the current effectiveness is not significant, and there is even a positive correlation between energy conservation and environmental protection fund inputs and environmental tax revenue. For economically backward regions with a high concentration of heavily polluting enterprises, it is essential to identify the pollution nature of enterprises in investment promotion and industrial development to reduce the consumption involved in adjusting pollution introduced. Reducing the pursuit of short-term performance goals and political promotions for officials is crucial. Even if the current impact is lagged, quality development should be pursued in budget management and investment, with reasonable planning of the government's long-term budget performance goals across years.

6.2. Force Enterprises to Transform and Enhance Corporate Responsibility

Enterprises are the main entities in economic development. Due to the spontaneous nature of market profit-seeking, government macro-control and guidance are necessary. However, enterprises should also strengthen their awareness and responsibility for high-quality development. In their own development process, enterprises should promote equipment upgrades to reduce environmental pollution. High-pollution and high-energy-consuming enterprises should actively seek favorable policies within their reasonable interests and shift from receiving policy support to aligning with policies. By developing their strengths and securing special funds from central and local governments, enterprises can alleviate pressure while building a good reputation and improving market competitiveness.

6.3. Encourage Innovation and R&D, and Promote Quality Development

The values of the estimators being complex numbers indicate that corporate R&D and innovation have an avoidance effect on environmental tax. Enterprises should increase their R&D and innovation investments to enhance their pollution control capabilities and reduce payable environmental taxes. Additionally, aligning more with government innovation and R&D policies can reduce the counteracting effects of environmental regulations, decrease intermediate management costs like fines for violations, and relieve development pressure. Innovation also increases enterprises' attractiveness to capital, reducing the financial burden on enterprises. Environmentally advantageous enterprises can receive better consideration in company listings, which is beneficial for their long-term development.

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