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An Empirical Study on the Short-term Impact of the Environmental Protection Fee-to-Tax Reform on Corporate Investment Efficiency

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Abstract

This paper uses non-financial A-share listed companies in China from 2010 to 2020 as research samples, utilizing the quasi-natural experiment conducted through the implementation of the "Environmental Protection Tax Law". The study investigates the short-term impact of the environmental protection fee-to-tax policy on corporate investment efficiency using a generalized difference-in-differences approach. The results indicate that the implementation of the environmental protection fee-to-tax policy significantly suppresses corporate investment efficiency in the short term and increases firms' inefficient investment. Furthermore, it is found that the policy exacerbates the problem of corporate overinvestment, whereas its impact on underinvestment is not significant. After conducting robustness tests by substituting the dependent variables, the conclusion remains valid. Subsequent heterogeneity analysis was conducted, differentiating between state-owned controlling enterprises and non-state-owned controlling enterprises based on the proportion of state capital, compared to state-owned controlling enterprises, the impact of the policy is more significant on non-state-owned controlling enterprises; Additionally, the policy effects across different economic regions of China were analyzed, revealing that the policy's effect is most significant in the eastern region, significant in the western region, but not significant in the central region. The conclusions of this study further enrich the empirical evidence of the micro-effects of environmental regulation, extending the research on the effects of the environmental fee-to-tax policy, and also provide suggestions for policymakers to formulate effective market-incentive-based environmental regulatory policies.

Keywords

Fee-to-Tax; Investment Efficiency; Copyright; Crowding-out Effect.

1. Introduction

At the Fifth Plenary Session of the 19th Central Committee of the Communist Party, General Secretary Xi Jinping emphasized the unwavering implementation of the new development concepts of innovation, coordination, green, openness, and sharing, using reform and innovation as the fundamental driving force to promote high-quality development. He proposed the long-range objectives of achieving a fundamental improvement in the ecological environment and essentially realizing the construction of a beautiful China by 2035. China's economic development is currently at a critical juncture, transitioning from a phase of rapid growth to a stage of high-quality development, shifting from extensive growth that primarily consumes resources to intensive growth that emphasizes quality and economic efficiency. To promote green and high-quality economic development, implement the concept of green development, and carry out the development strategy that "lucid waters and lush mountains are invaluable assets", China have formulated a series of environmental protection policies,

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attempting to correct the negative externalities caused by corporate environmental impacts through the use of economic incentives in environmental regulation. On January 1, 2018, China officially promulgated and implemented the "Environmental Protection Tax Law of the People's Republic of China." It is the country's first tax law dedicated to environmental protection and reflects the "green tax system," stipulating that the tax collected is to be specifically used for environmental protection, ensuring the principle of "dedicated funds for dedicated purposes." With this, the previous regulations on the collection of pollution fees were completely abolished, replaced by the more enforceable and binding environmental protection tax.

Before the implementation of the Environmental Protection Tax Law, China had long adopted a pollutant discharge fee system to regulate corporate behavior. Compared to the pollutant discharge fee system, the environmental protection tax boasts a higher legal status and an independent tax collection department, serving as a more effective regulatory tool to address environmental externalities, overcoming the various shortcomings of the previous fee system and fostering the green and high-quality development of our economy [1]. The reform from environmental protection fees to taxation can better address the various issues associated with the previous discharge fees, representing an urgent need and correct choice for ameliorating the country's increasingly deteriorating environmental condition [2-3]. The scope of the Environmental Protection Tax Law encompasses solid waste, noise, atmospheric pollutants, and water pollutants, with varying tax rates applied based on emission levels to incentivize "higher emissions, higher taxes; lower emissions, lower taxes." At present, guided by national environmental policies and the drive for sustainable development strategies, China's investment in environmental protection has shown an overall increasing trend year by year, continually enhancing the effectiveness of the pollution control battle and overall improvement in environmental quality. From 2016 to 2020, China's national fiscal expenditure in the field of ecological protection reached 4.4212 trillion yuan, growing at an annual rate of 8.2%. Of this, the central government's contribution amounted to 43.7%, totaling 1.9333 trillion yuan. However, it is undeniable that the significant achievements in environmental protection and management at the current stage have been achieved at the cost of substantial financial and material resources, which has had a significant adverse impact on some enterprises in the capital market. To comply with legal and regulatory requirements, resources are diverted from their primary businesses, inhibiting growth and further limiting investment opportunities.

Under the "new economy", it is imperative to fully leverage the decisive role of the market in resource allocation and enhance the role of the government. For enterprises, as microentities of the market, effective financial management and making rational financial decisions in investment, financing, and profit distribution are the most crucial aspects of development. Enhancing corporate investment efficiency to aid China's economy in reaching a stage of high-quality development is a topic of significant focus in both theoretical and practical fields. When enterprises invest, they face choices: whether to allocate resources to production operations, external projects, or equity investments. Since the sources of resources obtained by enterprises vary, the capital costs they bear will also differ. As rational economic agents, firms reach the optimal investment level when the marginal cost of investment equals the marginal benefit. If the marginal benefit exceeds the marginal cost, it indicates underinvestment by the firm; whereas if the marginal benefit is less than the marginal cost, it implies overinvestment. The primary driving force for enterprise growth comes from efficient investment; effective investment is not only related to the future development of the enterprise but also affects the high-quality development of our country's economy [4]. Regarding how the policy shift from environmental protection fees to taxes affects corporate investment efficiency in the short term, this paper investigates the issue using data from China's A-share non-financial listed companies and applying a generalized difference-in-differences approach. The paper also conducts a heterogeneity analysis of the environmental protection fee-to-tax policy effect, finding that

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non-state-controlled firms are more reflective of the policy's impact compared to state-owned enterprises; and that firms in the eastern region are more affected than those in the central and western regions. Lastly, after robustness tests with the method of replacing variables and placebo tests, the conclusion remains unchanged.

The marginal contributions of this paper are mainly reflected in the following three aspects: First, it expands the research on the effects of environmental regulatory tools on the behavior of microeconomic agents in the market, whereas existing literature mostly focuses on testing the "double dividend" hypothesis of environmental regulatory tools, that is, whether they can lead to environmental improvement and sustainable economic development. Secondly, previous studies have mainly focused on pollution fees or environmental protection taxes as their primary subjects, but this paper, from the perspective of the fee-to-tax reform, investigates the behavior of micro-agents—investment, thereby enriching the empirical evidence of how market-based environmental regulatory tools affect corporate investment behavior. Furthermore, this paper conducts a heterogeneity analysis on the proportion of state-owned capital and region, deriving different policy effects for state-owned holdings and different regions, which provides references for government departments to formulate scientifically sound and effective environmental regulatory policies.

The structure of the remainder of this paper is organized as follows: Section two provides a literature review and proposition of hypotheses; Section three describes the data sample and research design; Section four reports the main econometric analysis results; Section five provides the research conclusions and policy recommendations.

2. Literature Review and Proposition of Hypotheses

Environmental regulatory tools are an important means of correcting the externalities caused by environmental pollution. Depending on the regulatory body, these tools are divided into three categories namely command-and-control (such as market access), market-based incentives (such as environmental protection taxes), and public participation in environmental regulation (such as public interest litigation). Environmental regulation has multiple impacts on corporate development. On the one hand, compliance requirements increase production costs for companies and investment in environmental protection and technological innovation crowds out some of the productive investment capital. Gray et al. (1998) found that environmental regulation has a "crowding-out effect", which reduces the productive investment of companies and decreases their operating profits [5]. Wang Xiaohong et al. (2020) found that on a macro level, environmental regulation abnormally reduces the investment scale of enterprises, thereby reducing the investment efficiency of enterprises [6]. On the other hand, environmental regulation can incentivize technological innovation in companies. The results of technological innovation can bring competitive advantages to enterprises, thereby bringing more economic profits. Porter et al. believed that there is a "Porter effect" in environmental regulation, which can not only bring about environmental dividends, but also create economic dividends [7]. Companies enhance their competitiveness and productivity through technological innovation, gaining larger market share and profit margins. Innovation compensation can fully offset the additional costs brought about by environmental protection. Some scholars believe that the impact of environmental regulation on micro-enterprises is complex. Studies by Lanoie et al. (2008) and Zhang Cheng (2011) have found a "U-shaped" relationship between environmental regulation and technological innovation, where weaker regulatory intensity leads to a reduction in the rate of technological advancement in production, while stronger regulatory intensity increases it [8-9]. Wu Lei et al. (2020) discovered that market-incentive environmental regulations have a suppressive effect on green total factor productivity in the short term but are promotive in the long term [10]. Currently, the existing

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literature on environmental protection taxes is relatively limited, while research on pollution charge systems is more abundant, with ongoing debates regarding their effectiveness. Some studies suggest that the effluent fee system can play a significant incentive role in pollution control and energy conservation and emission reduction [11]. However, some studies have pointed out that there are a series of shortcomings in the implementation of the pollutant discharge fee system, such as excessively low collection standards, over-administration, and insufficient enforcement rigidity, which greatly affect the effectiveness of pollution control and energy conservation and emission reduction [12]. There even exists a situation where the standards for pollutant discharge fees are set lower than the cost of corporate pollution control during implementation, leading to companies "paying to pollute legally". Regarding the policy implementation of converting environmental protection fees to taxes, some scholars believe that the pollutant discharge fee and the environmental protection tax are essentially similar, as the environmental tax follows the principle of "tax burden shifting," with its scope of collection, range, and methods of taxation being consistent with the pollutant discharge fee system, representing no substantial change, possibly only a change in name, not constituting significant progress [13]. Other scholars contend that the environmental protection tax, compared to the pollutant discharge fee system, is a more coercive, enforceable, and supervisory environmental regulatory tool, and the resulting cost and supervisory pressures would compel enterprises to engage in environmental governance [14]. On the impact of the establishment of an environmental protection tax on corporate investment efficiency, two opposing views exist in the theoretical field: one view suggests that the establishment of an environmental tax would increase companies' pollution costs and enhance government regulatory efforts, thereby causing the efficiency of companies' internal resource allocation to deviate from their optimal level. Hu Wei et al. (2018) found that the initiation of the environmental tax has produced negative market effects for various types of enterprises in the short term [15]. Another viewpoint holds that the establishment of an environmental protection tax can motivate enterprises to engage in productive innovation, optimize and integrate internal resources further, thereby enhancing the investment efficiency of enterprises. Yu Lianchao et al. (2021) found that the conversion from environmental protection fees to taxes can effectively promote productive technological innovation in enterprises and thus enhance their capacity utilization rate [1]. So, is the conversion from environmental protection fees to taxes merely a change in name, with no substantial impact on the micro-entities in the market, or will it lead companies to focus more on production technology innovation to enhance investment efficiency, or perhaps it will cause enterprises to crowd out necessary investment, thereby suppressing investment efficiency? This paper empirically investigates the impact of the implementation of the environmental protection fee-to-tax reform policy on corporate investment efficiency from the perspective of fee-to-tax reform. Due to the timing of the policy implementation and the data collection period, the study primarily focuses on the short-term impact of the environmental protection fee-to-tax reform on corporate investment efficiency.

The environmental protection tax system, as a significant market-based environmental regulation in China, can effectively correct the negative externalities caused by environmental pollution, and is an environmental economic policy tool that is effective, preventive, and sustainable, and is a vital component of China's environmental economic policies and environmental policy framework. Compared to the pollutant discharge fee system, the environmental protection tax has the following characteristics. Firstly, the environmental protection tax is enshrined in law, has a higher legal status, covers a broader range, enforces more strongly, and is subject to stricter regulation. Secondly, the environmental protection tax is collected by the tax authorities, making it more independent and less influenced by government departments compared to the environmental departments responsible for collecting pollutant discharge fees, resulting in a more rigid policy enforcement. Thirdly, most

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regions have set their environmental tax rates at a higher level than the national standard, resulting in an overall tax burden that is higher than the previous pollutant discharge fees in most areas. The overall increase in the environmental tax burden, the intensified enforcement, and the certainty of policy direction compel enterprises to increase compliance investments in the short term, increase operating costs, squeeze profit margins, and impact competitiveness, leading to inefficient investments for businesses. Consequently, this paper proposes Hypothesis 1.

H1: The conversion of environmental protection fees to taxes will have a restraining effect on corporate investment efficiency in the short term.

To further analyze the heterogeneous policy effects of the transformation from environmental protection fees to taxes, this paper posits that since the tax rates and amounts of the environmental protection tax are determined by local governments based on national standards, and the legal environments vary from region to region, the impact of this tax reform on corporate investment efficiency in the short term will differ across regions, with areas that have set higher tax standards and have better legal environments experiencing a greater degree of regulation on local enterprises. Due to the higher tax standards set, local enterprises are forced to allocate more productive resources in the short term to meet compliance requirements, thereby to a certain extent reducing the scale of investment, causing investment efficiency to deviate from its optimal state. Additionally, due to the better legal environment, the enterprises in these regions are subject to stricter regulation and constraint, which to some extent prevents local governments from adopting lenient measures towards local enterprises' polluting activities for the sake of their own performance, thereby reducing the possibility of collusion between government and business to some extent. Therefore, different regions exhibit different policy effects. As a result, this paper proposes Hypothesis 2.

H2: There are heterogeneous policy effects of the environmental protection fee-to-tax reform on enterprises in different regions.

Due to the different composition of shareholding in listed companies, enterprises with different types of shares possess significantly different resources, and there are distinct systems of promotion incentives and policy support within corporate structures. This paper considers enterprises with state-owned shares accounting for more than 50% of total equity as state-controlled enterprises, while others are considered non-state-controlled. Compared to non-state-controlled enterprises, state-controlled enterprises are generally under the administration of the State-owned Assets Supervision and Administration Commission (SASAC), giving them more policy-related advantages, less financing constraints, and better investment opportunities. Furthermore, due to the political advantages held by state-controlled enterprises, they do not prioritize profit maximization as their ultimate goal, unlike private enterprises. State-controlled enterprises often have to take into account other long-term factors when setting their goals, such as national employment and environmental issues, moreover, the promotion mechanisms within state control include aspects of social responsibility, making their goals often tangible and actionable. Thus, the impact of changes in the environmental protection fee-to-tax policy may be smaller on them. Consequently, considering the differences in ownership characteristics, state-controlled enterprises and non-state-controlled enterprises may have different responses and adaptabilities to the environmental protection fee-to-tax policy. Based on this, we can propose the following hypothesis:

H3: The policy effect of the change from environmental protection fees to taxes is heterogeneous across enterprises of different ownership.

(1)

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3. Research Design

3.1. Sample Selection and Sources of Data

This paper selects listed companies in the Shanghai and Shenzhen A-share market as research samples, covering the period from 2010 to 2020. Industrial enterprises are classified according to the "Listed Companies Environmental Protection Inspection Industry Classification Management Catalog" and the "2012 China Securities Regulatory Commission Industry Classification", identifying 14 industries including thermal power, steel, cement, and electrolytic aluminum as high-pollution enterprises, with others categorized as non-high-pollution enterprises. Additionally, the following data filtering was conducted: (1) financial and insurance companies were excluded; (2) companies designated as ST, *ST, and PT were excluded; (3) companies with significant data missing were excluded. To eliminate the influence of outliers, continuous variables were winsorized at the 1% percentile level, resulting in a final sample of 25,326 observations. The relevant financial data for this paper were sourced from the CSMAR database, and data analysis and processing were performed using Stata16 and Excel.

3.2. Model Specification

This paper employs a generalized Difference-in-Differences (DID) approach to examine the short-term impact of the "Environmental Protection Fee to Tax" reform on the investment efficiency of firms, dividing the study sample into treatment and control groups, and treating the "2018 Ministry of Environmental Protection's implementation of the Fee-to-Tax policy" as an exogenous event. In accordance with Lian Chao et al. 1, since the Fee-to-Tax policy reform has imposed stricter regulatory measures on heavily polluting firms, providing stronger incentives and restrictions for them, while the impact on non-heavily polluting firms is not significant, heavily polluting enterprises are designated as the experimental group and non-heavily polluting enterprises as the control group.

Based on the settings of this paper, the following model was constructed:

$$EI_{i,t} = \alpha_0 + \beta_1 treat_i + \beta_2 time_t + \beta_3 treat_i * time_t + \beta_4 control_{i,t} + \varepsilon_{i,t} \quad (1)$$

In model (1), i denotes firms, t denotes time, and $EI_{i,t}$ is the dependent variable representing the set of firms' investment efficiency; $treat_i$ is a binary grouping dummy variable that takes the value of 0 or 1, $time_t$ is a binary time dummy variable that also takes the value of 0 or 1, $treat_i * time_t$ is the interaction term that measures the net effect of the policy's exogenous shock, $control_{i,t}$ represents the collection of control variables; α_0 is a constant, and $\beta_1, \beta_2, \beta_3, \beta_4$ are the coefficients for the corresponding variables, $\varepsilon_{i,t}$ is the error term of the model. The β_3 coefficient estimated using data is the net effect of the policy

3.3. Model Specification

3.3.1. Dependent variable

The dependent variable of this paper is corporate investment efficiency, referring to Richardson's (2006) [16] model, using the absolute value of the regression residuals as a proxy variable for investment efficiency (EI), as shown in equation (2).

$$Inv_{i,t} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 CF_{i,t-1} + \alpha_3 Age_{i,t-1} + \alpha_4 Lev_{i,t-1} + \alpha_5 Size_{i,t-1} + \alpha_6 Roe_{i,t-1} + \alpha_7 Inv_{i,t-1} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (2)$$

Here, i represents listed companies, and t represents the year. Inv is the company's investment expenditure, defined as the ratio of cash paid for fixed assets, intangible assets, and other long-term assets minus the net cash received from the disposal of these assets to the total assets at the end of the period; Q is the company's investment opportunity in year t-1, represented by the growth rate of operating income, CF is the cash holdings of the company in year t-1, Age is

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the age of the company's listing in year t-1, Lev is the asset-liability ratio in year t-1, Size is the natural logarithm of the total assets of the company at the end of year t-1, Roe is the return on equity of the company in year t-1. Furthermore, annual and industry dummy variables are introduced in the model to control for time and industry effects, with industry classification based on the China Securities Regulatory Commission's Industry Classification (2012), Similarly, to exclude the influence of outliers, all variables have been winsorized at the 1% quantile level. ε is the model's residual, and the absolute value of the residual represents investment efficiency, The larger the residual, the greater the deviation from the optimal investment level and the lower the investment efficiency of the company. Meanwhile, if the residual is less than 0, it is considered that the company's investment is insufficient; if the residual is greater than 0, it is considered that the company's investment is excessive.

3.3.2. Explanatory variable

The explanatory variables include group dummy variables ($treat_i$), time dummy variables ($time_t$), and the interaction term of both ($treat_i * time_t$). Herein, $treat_i$ indicates whether firm i is subjected to an exogenous policy shock, with $treat_i$ = 1 for treated firms and $treat_i$ = 0 otherwise; $time_t$ indicates whether the policy is implemented in year t, with the Environmental Protection Tax Law enforced on January 1, 2018, thus $time_t$= 1 post this date and $time_t$ = 0 prior; The interaction term $treat_i * time_t$ is the core explanatory variable, being 0 before the policy implementation for the treatment group and 1 thereafter; For the control group, $treat_i * time_t$ remains 0 regardless of the policy implementation.

3.3.3. Control variables

Building on the research of predecessors [17-19], this paper selects the following variables as control variables: firm size (Size), financial leverage (Lev), return on net assets (Roa), equity concentration (Share), firm age (Age), the proportion of free cash flow (Fcf), the proportion of fixed assets (Ppe), stock return rate (Ret), and audit opinion (Audit). Definitions of each variable are provided in Table 1.

Table 1: Definitions and Descriptions of Variables

Variable Name	Variable Symbol	Variable Definition
Investment Efficiency	EI	Efficiency of investment computed in accordance with Richardson (2006)
Group Dummy Variable	Treat	1 for the treatment group, which refers to high-pollution industry firms; 0 for the control group, which refers to non-high-pollution industry firms
Time Dummy Variable	Time	1 for the period after the tax-for-fee reform; 0 for before the reform
Firm Size	Size	Natural logarithm of the total assets at the end of the period
Financial Leverage	Lev	Total liabilities divided by total assets
Return on Net Assets	Roa	The ratio of net profit to total assets
Equity Concentration	Share	Sum of the shareholding percentages of the top ten shareholders
Firm Age	Age	Natural logarithm of the number of years the company has been listed
Free Cash Flow Proportion	Fcf	Free cash flow divided by total assets

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Proportion of Fixed Assets	Ppe	Company's fixed assets divided by total assets
Stock Return Rate	Ret	Annual return rate of the company's stock considering reinvestment of cash dividends
Audit Opinion	Audit	0 for standard unqualified audit opinion, otherwise 1

4. Empirical Analysis

4.1. Descriptive Statistics

Table 2 reports the descriptive statistical results of the main variables. As seen from Table 2, the mean and median of EI are 0.043 and 0.027, respectively. This indicates that the proportion of inefficient investment to total assets in listed companies is about 4.3%, and the median size of inefficient investment accounts for 2.7% of total assets. With EI's minimum value at 0 and the maximum value at 0.465, there appears to be a significant disparity in investment efficiency among different listed companies in China. The findings of Liu Huilong et al. (2014) also corroborate this result [20]. The mean of Time shows that 36.2% of the samples are during the policy treatment period.

Table 2: Descriptive Statistics of Main Variables

Explanatory Variables	Count	Mean	Standard Deviation	Median	Minimum Value	Maximum Value
EI	25326	0.043	0.055	0.027	0	0.465
Treat	25326	0.277	0.447	0	0	1
Time	25326	0.362	0.481	0	0	1
Size	25326	22.283	1.319	22.103	17.641	28.636
Lev	25326	0.444	0.209	0.439	0.007	3.919
Roa	25326	0.030	0.100	0.033	-4.946	0.786
Share	25326	56.837	15.190	57.437	1.310	101.16
Age	25326	2.878	0.338	2.944	1.099	3.989
Fcf	25326	0.151	0.118	0.120	-0.060	0.972
Ppe	25326	0.218	0.166	0.184	0	0.971
Ret	25326	0.129	0.549	0.007	-0.826	14.278
Audit	25326	0.035	0.184	0	0	1

4.2. Parallel Trends Test

The primary condition for establishing a Difference-in-Differences (DiD) model is the parallel trends assumption. This assumption implies that, prior to any policy shock, the trends in the experimental (treatment) group and the control group should be roughly the same. Otherwise, the DID method may incorrectly estimate the effect of the policy shock. In this study, following the approach of La Ferrara et al. (2012) [21], we include a series of interaction dummy variables between year and treatment to conduct regression analysis. This is done to examine the yearly effects of policy implementation and to test whether the experimental and control groups conform to the parallel trends assumption.

Figure 1 illustrates the trend of coefficient estimates and the 95% confidence intervals from 2015 to 2020, representing the results of the parallel trends test. In the graph, "current" refers to the time point of the policy occurrence in 2018, "pre1", "pre2", and "pre3" represent one year, two years, and three years before the policy, corresponding to 2015, 2016, and 2017,

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respectively. Meanwhile, "post1" and "post2" represent one and two years after the policy, corresponding to 2019 and 2020. As can be seen from the figure, before the implementation of the environmental protection fee-to-tax policy from 2015 to 2017, the estimated parameter confidence intervals include zero, indicating no statistically significant difference between the experimental and control groups, thus supporting the parallel trends assumption. However, after the official implementation of the fee-to-tax policy from 2018 to 2020, there emerged a significant divergence in the investment efficiency trends between the experimental and control groups. Based on this, it can be concluded that the control group selected for this study is comparable to the treatment group in the pre-policy shock period, satisfying the parallel trends test.

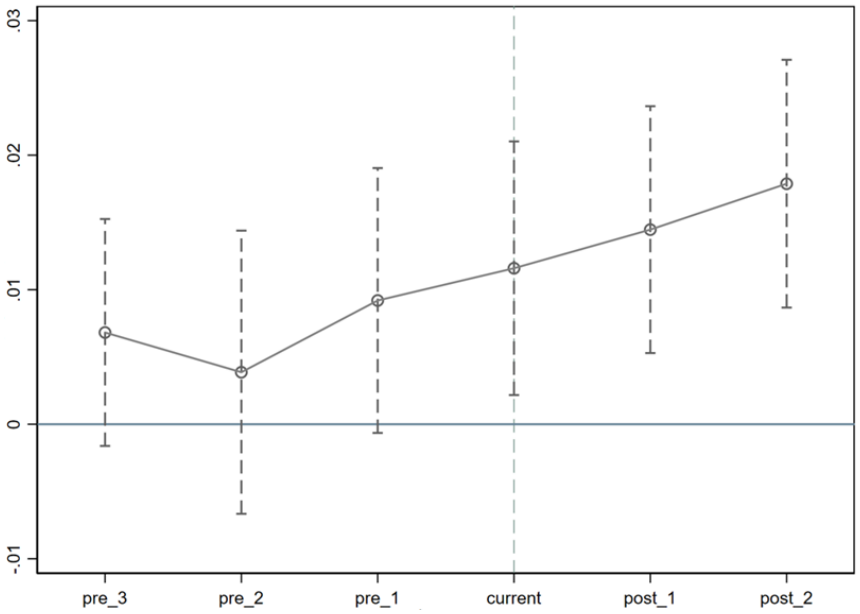

Figure 1: Parallel Trends Test

4.3. Benchmark Regression

Using a Difference-in-Differences approach on Model (1), Table 3 reports the regression results on the short-term impact of the environmental protection fee-to-tax reform on firm efficiency. Column (1) shows the average impact of the environmental protection fee-to-tax reform on the investment efficiency of listed companies without controlling for any variables. The value of the interaction term is 0.00423, significant at the 1% level, indicating that in the short term, the reform has increased firms' compliance-related investment expenditures, squeezed investment opportunities, and led to inefficient investments by firms. This provides preliminary evidence supporting Hypothesis 1 (H1). Column (2) shows the regression results with related control variables included. The coefficient of the interaction term is 0.0037, significant at the 5% level, suggesting that the fee-to-tax policy can significantly reduce investment efficiency in the short term, further validating H1. Subsequently, firms are divided into those with overinvestment and those with underinvestment for group-specific regression analysis. Column (3) presents the regression results for overinvesting firms after controlling for variables, with the interaction term coefficient being 0.00947, which is significant at the 5% level. This indicates that the fee-to-tax policy in the short term may lead to overinvestment. This could be because firms are increasing their environmental protection investments to comply with environmental regulations. Investments in environmental protection are often part of a firm's long-term strategic plan, and these investments typically do not generate positive cash flow in the short term. Column (4) presents the regression results for firms with underinvestment after controlling for variables. The interaction term coefficient is -0.000148, but the result is not

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significant. Therefore, the impact of the environmental protection fee-to-tax reform on firms with underinvestment is not significant.

Table 3: Regression Analysis Results

Variables	(1) EI	(2) EI	(3) O_EI	(4) U_EI	(5) EI
Treat*Time	0.00423***	0.00367**	0.00947**	-0.000148	0.000058
Control Variables	Not Controlled	Controlled	Controlled	Controlled	Controlled
N	25326	25326	9295	16031	25326
AR2	0.008	0.0261	0.0430	0.0561	0.0214
F	69.44***	57.61***	35.79***	80.43***	47.19***

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. T-statistics for regression coefficients are reported in parentheses. The same applies below.

4.4. Placebo Test

To rule out the impact of other environmental policies on the empirical results, this study conducted a placebo test. The study assumes that the environmental protection fee-to-tax reform was implemented in 2016. It reconstructed the time dummy variable and the interaction term with the group dummy variable and then carried out a Difference-in-Differences regression analysis. The regression results, as shown in Table 3 column (5), indicate that the estimated coefficient of the interaction term is 0.000058, which is not statistically significant. This regression outcome suggests that if the environmental protection fee-to-tax reform were assumed to have occurred in 2016, the short-term positive impact of the reform on firms' inefficient investment would no longer be significant. This indirectly confirms the reliability of the conclusions drawn in this paper. Therefore, after the placebo test, the conclusions of this study still hold.

4.5. Robustness Test

To enhance the robustness of the research findings, the following methods were used to perform robustness checks.

Firstly, shortening the sample period. The original study sample period ranged from 2010 to 2020, which may include noise due to the extended duration before the implementation of the environmental protection fee-to-tax reform. To reduce the potential impact of this issue on the results, the study narrowed the sample period to three years before and after the reform, selecting data from 2015 to 2020, totaling 16,419 observations. Using the Difference-in-Differences method for regression, the results are shown in Table 4 column (1). The regression coefficient of the interaction term is 0.00579 and is significant at the 1% level, indicating that the implementation of the environmental protection fee-to-tax reform significantly lowers investment efficiency in the short term. This suggests that the study's conclusions remain valid.

Secondly, alternative measurement for the dependent variable. The main text of the paper uses the Richardson model to measure firms' investment efficiency. For robustness, the Biddle (2009) [22] model was used as an alternative to measure investment efficiency. The regression results, as presented in Table 4 column (2), show that the interaction term is 0.00393 and significant at the 5% level. This also indicates that the research conclusions hold true.

These robustness checks confirm that the initial findings regarding the negative impact of the environmental protection fee-to-tax reform on corporate investment efficiency are reliable and not driven by the choice of sample period or measurement method.

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Table 4: Robustness Test Results

Variables	(1) EI	(2) EI
Treat*Time	0.00579***	0.00393**
Control Variables	Controlled	Controlled
N	16419	25044
AR2	0.0384	0.0261
F	55.60***	47.01***

4.6. Heterogeneity Test

4.6.1. Regional Differences in Enterprises

Given the uneven economic development across regions in China, local governments are allowed to adjust the tax rates for taxable pollutants within a prescribed range, leading to substantial differences in the standards of the fee-to-tax reform across regions. This, in turn, affects corporate behavior differently. To examine the impact of the fee-to-tax policy on investment efficiency among local enterprises in different economic regions, the study uses the registered location of listed companies for division and conducts group regression analysis. The regression results shown in Table 5 columns (1), (2), and (3) indicate that the fee-to-tax policy has a significant positive impact on inefficient investments by companies in the eastern region, while the impact is not significant in the central region, and it is significant in the western region. These results validate Hypothesis 2 (H2). In the eastern region, the more significant impact may be due to the adoption of better tax rate benchmarks. In cities like Shanghai, Jiangsu, Hebei, Henan, Tianjin, and Beijing, the tax amounts for atmospheric pollutants are 4 to 10 times higher than the minimum standard, and for water pollutants, they are 3.5 to 10 times higher. In contrast, provinces in the central and western regions have not raised their tax amounts as much. The policy effect in the western region might be a result of the reform shaking the previous ties between the government and enterprises, reducing the possibility of collusion between them and forcing enterprises to adjust their development models. Enterprises can either bear the increased tax burden to maintain their original production processes or they can innovate technologically, investing in new sources of long-term production vitality. Therefore, the exogenous shock of the fee-to-tax policy does not have a significant impact on the investment efficiency of enterprises in the central region, while it has a significant restraining effect on the investment efficiency of enterprises in the eastern and western regions in the short term.

Table 5: Regression Results of Regional Heterogeneity Test

Variables	(1)East EI	(2)Central EI	(3)West EI
Treat*Time	0.00507***	-0.00265	0.00709*
Control Variables	Controlled	Controlled	Controlled
N	17469	4292	3565
AR2	0.0283	0.0279	0.0244
F	43.41***	11.27***	7.40***

4.6.2. Ownership Differences

To explore the differential impact of the fee-to-tax policy on the investment efficiency of enterprises with varying proportions of state-owned capital, the study divides enterprises into state-owned holding and non-state-owned holding based on whether the state-owned capital accounts for more than 50%, and conducts group regression analyses. The regression results

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shown in Table 6 columns (1) and (2) indicate that the environmental protection fee-to-tax reform has a significant inhibitory effect on the investment efficiency of non-state-owned holding enterprises but does not significantly affect the investment efficiency of state-owned enterprises. This confirms Hypothesis 3(H3). Compared with non-state-owned holding enterprises, state-owned holding enterprises have advantages such as political connections and are less subject to financing constraints. They can invest in long-term green production capabilities without having to squeeze much of the productive investment in the short term, and can seize investment opportunities, so their growth is not significantly affected. Additionally, state-owned holding enterprises had a more stringent and comprehensive system for assessing social responsibilities and environmental protection standards prior to the fee-to-tax policy reform. As a result, compliance operations for state-owned holding enterprises do not require significant short-term investments, allowing them to transition more effectively and smoothly through this phase. Therefore, the environmental protection fee-to-tax reform does not have a significant impact on state-owned holding enterprises, while it may inhibit the investment efficiency of non-state-owned holding enterprises in the short term.

Table 6: Regression Results of Regional Heterogeneity Test

Variables	(1) State-Owned EI	(2) Non-State-Owned EI
Treat*Time	0.02497	0.00370**
Control Variables	Controlled	Controlled
N	500	24826
AR2	0.0495	0.0264
F	3.40***	57.02***

5. Conclusion

This paper takes listed companies in China from 2010 to 2020 as the research sample, utilizing the quasi-natural experiment of the implementation of the "Environmental Protection Tax Law", and explores the short-term impact of the environmental protection fee to tax reform on corporate investment efficiency using a generalized difference-in-differences approach. The study finds that: (1) the environmental protection fee to tax reform policy has a significant positive effect on firms' non-investment efficiency in the short term, in other words, the implementation of the "Environmental Protection Tax Law" will reduce corporate investment efficiency in the short term. Additionally, the inefficiency in investment is mainly due to over-investment, while the impact on underinvestment is not significant. (2) The short-term effects of the environmental protection fee to tax policy are more pronounced in the eastern economic regions, due to the overall increase in tax burden in this area, which has a greater impact on listed companies. Additionally, the policy also has a significant effect in the western regions, as it reduces the likelihood of collusion between government and businesses, thus affecting the development model of listed companies, while it does not have a significant impact on companies in the central regions. (3) Compared to state-owned enterprises, the short-term effects of the environmental protection fee to tax policy are more pronounced in non-state-owned enterprises. The reason is that before the fee-to-tax reform, non-state-owned enterprises had less comprehensive systems for assessing social responsibility and environmental standards. After the policy implementation, these companies face greater pressure in terms of costs and capital requirements. They need to invest to meet compliance requirements and, lacking government-related advantages, they are more susceptible to financing constraints.

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Since the 18th National Congress, the government have upheld the development philosophy that "lucid waters and lush mountains are invaluable assets", and public environmental awareness has been strengthening, leading China's economy towards high-quality development. The implementation of the Environmental Protection Tax Law has sent a definitive signal, incentivizing corporate investment behavior. In the short term, businesses must increase their investments to meet environmental standards, and to gain long-term competitive advantages, they may have to forgo some opportunities for growth investment. Furthermore, investments in environmental protection cannot rapidly drive business transformation or increase productivity in the short term, nor can they generate positive cash flow promptly, leading to short-term investment inefficiency in businesses. The implementation of the shift from environmental protection fees to taxes may exert significant operational pressure on some businesses, and in order to facilitate a smooth transition and achieve long-term "Porter effects," this paper offers the following suggestions based on research findings. First, establish more appropriate tax arrangements that better reflect the principle of "higher emissions, higher taxes; lower emissions, lower taxes," fully mobilizing the enthusiasm of enterprises to proactively invest in environmental protection. For instance, allow for a greater tax deduction for environmental protection investments, which can be applied over a longer period. Second, increase state support for corporate environmental projects, especially for non-state-owned enterprises, by offering higher financing amounts and lower financing rates to prevent companies from forsaking other investment opportunities due to compliance investment needs. Third, each region should establish standards that are more suitable for itself, strengthen inter-regional cooperation to avoid policy loopholes that lead to the transfer of pollution, and the assessment of local government officials should place greater emphasis on environmental protection, setting more scientific and rational evaluation criteria to prevent the ineffectiveness of government orders.

References

[1] Yu Lianchao, Sun Fan, Bi Qian, Liu Qiang. Does the Transformation from Environmental Protection Fees to Taxes Help Improve Corporate Capacity Utilization? - Quasi-Natural Experimental Evidence from the Implementation of the Environmental Protection Tax Law[J]. Journal of Shanghai University of Finance and Economics, 2021, 23(04):32-47.

[2] Li Jiyou. The Impact of the Environmental Protection Fee Reform on China's Ecological Environment and Economic Development[J]. Management World, 2017(3):2.

[3] Ding Rijia, Ding Wenjun. A Study on the Pluralistic Collaborative Governance of Environmental Protection Tax Based on Institutional Analysis and Development Framework[J]. Taxation Research, 2020(07):116-120.J. Liu, E.L. Chen and Z.T. He: Journal of Shi Jia Zhuang Railway Institute (Natural Science), Vol. 22 (2009) No. 4, p.40-42.

[4] Lü Changjiang, Zhang Haiping. The Effect of Equity Incentive Plans on Corporate Investment Behavior[J]. Management World, 2011(11):118-126+188.

[5] Gary C. Biddle, Gilles Hilary, Rodrigo S. Verdi. How does financial reporting quality relate to investment efficiency?[J]. Journal of Accounting and Economics, 2009,48(2):

[6] Wang Xiaohong, Wang Mengyao, Hao Ting. Study on the Impact of Environmental Regulation and Government Subsidies on the Investment Efficiency of Listed Manufacturing Companies[J]. Inner Mongolia Science Technology and Economy, 2020(14):37-38+40.

[7] Michael E. Porter, Claas van der Linde. Toward a New Conception of the Environment-Competitiveness Relationship[J]. The Journal of Economic Perspectives,1995,9(4):

[8] Lanoie P, Lajeunesse P R. Environmental regulation and productivity: testing the porter hypothesis[J]. Journal of Productivity Analysis, 2008, 30(2):121-128

[9] Zhang Cheng, Lu Yang, Guo Lu, Yu Tongshen. The Intensity of Environmental Regulation and Technological Progress in Production[J]. Economic Research Journal, 2011, 46(02):113-124.

ISSN: 2710-0170

[10] Wu Lei, Jia Xiaoyan, Wu Chao, Peng Jiachao. The Impact of Heterogeneous Environmental Regulation on China's Green Total Factor Productivity[J]. China Population, Resources and Environment, 2020, 30(10):82-92.

[11] Guo Junjie, Fang Ying, Yang Yang. Has the Reform of Sewage Charge Standards Promoted the Reduction of Industrial Sulfur Dioxide Emissions in China?[J]. The Journal of World Economy, 2019, 42(01):121-144.

[12] Maung M, Wilson C, Tang X B. Political connections and industrial pollution: Evidence based on state ownership and environmental levies in China[J]. Journal of Business Ethics, 2016, 138(4) : 649-659.

[13] Wu, Tal. From Pollution Charge to Environmental Protection Tax: A Comparative Analysis of the Potential and Limitations of China's New Environmental Policy Initiative[J]. Journal of Comparative Policy Analysis: Research and Practice,2018,20(2):

[14] Li Qingyuan, Xiao Zehua. Heterogeneous Environmental Regulatory Tools and Corporate Green Innovation Incentives—Evidence from the Green Patents of Listed Companies[J]. Economic Research Journal, 2020, 55(09):192-208.

[15] Hu Wei, Long Zhenni, Hu Shunyi. Analysis of the Short-term Market Effects of the Implementation of the "Environmental Protection Tax Law"[J]. Finance and Accounting Monthly, 2018(20):56-62.

[16] Scott Richardson. Over-investment of free cash flow[J]. Review of Accounting Studies,2006,11(2-3):

[17] Zhang Tao, Wu Mengxuan, Zhou Lihong. Does Carbon Emission Trading Promote Corporate Investment Efficiency?—Quasi-Experimental Evidence from the Carbon Emission Trading Pilot[J]. Zhejiang Social Sciences, 2022(01):39-47+157-158.

[18] He Hongqu, Huang Lingfeng. Can the Collection of Pollution Fees Effectively Improve Corporate Performance?[J]. Research on Financial and Economic Issues, 2017(07):28-33.

[19] Niu Xiaoye, Liu Hongdi, Cao Zhiwen. An Empirical Study on the Impact of the Pollution Fee-to-Tax Reform on Corporate Environmental Protection Investment[J]. Friends of Accounting, 2021(21):74-81.

[20] Liu Huilong, Wang Chengfang, Wu Liansheng. Decision Rights Allocation, Earnings Management, and Investment Efficiency[J]. Economic Research Journal, 2014, 49(08):93-106.

[21] La Ferrara E, Chong A, Duryea S. Soap operas and fertility: Evidence from Brazil[J]. American Economic Journal: Applied Economics, 2012, 4(4): 1-31.

[22] Gary C. Biddle, Gilles Hilary, Rodrigo S. Verdi. How does financial reporting quality relate to investment efficiency?[J]. Journal of Accounting and Economics,2009,48(2):