

Impact of Environmental Protection Tax on the Credit Spreads of High-Pollution Enterprises

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Abstract: Taking the enactment of China's Environmental Protection Tax Law in 2018 as a policy intervention, this paper investigates the market impacts of environmental regulation from the lens of corporate debt financing costs. Leveraging data on highly polluting enterprises spanning 2009–2021, we construct a difference-in-differences (DID) model to assess the effect of environmental taxation on corporate credit spreads. Findings reveal that the implementation of the environmental tax policy significantly reduced corporate credit spreads, mitigating both default risk and financing costs. These conclusions remain robust following a series of robustness checks. Further heterogeneity analysis uncovers significant disparities in policy effectiveness across enterprises, with more pronounced impacts observed among larger firms and those with stronger credit profiles.

1. Introduction

As climate change and ecological degradation intensify globally, environmental taxation has emerged as a key market-based instrument to steer economies toward sustainability. By internalizing the cost of pollution, it incentivizes businesses to adopt greener technologies, improve resource efficiency, and transition to low-carbon models.

China's implementation of the environmental protection tax law in 2018 marked a pivotal shift from administrative commands to economic incentives in environmental governance. This policy lever aims to reduce emissions and strengthen corporate environmental accountability. For enterprises, environmental taxation presents a dual impact. It drives increased environmental investment, enhances long-term sustainability, and signals operational stability to investors, thereby improving market credibility. However, it also imposes short-term compliance costs and operational burdens, straining cash flow and posing significant challenges for firms with weak environmental foundations and limited transformation capacity. This underscores the need for balanced policy support alongside regulatory measures.

This study utilizes data from Chinese A-share listed companies spanning 2009–2021, focusing on highly polluting enterprises. Treating the environmental tax reform as a quasi-natural experiment, we construct a multi-period difference-in-differences (DID) model for inference. Baseline regression results indicate that the implementation of the environmental tax policy significantly

reduced credit spreads for treated enterprises. Specifically, by enhancing enterprises' environmental compliance, the policy bolstered market confidence, thereby lowering financing costs. To ensure result robustness, we conducted a series of tests including parallel trends verification, placebo tests, and exclusion of specific year samples, all of which aligned with the main regression findings. Further heterogeneity analysis reveals that the policy's effects vary across enterprise characteristics: the inhibitory impact on credit spreads is more pronounced among larger-scale and higher-credit-rating enterprises, whereas it is limited for smaller or less creditworthy firms [1]his paper transcends existing literature, which primarily focuses on the production-side effects of environmental taxation, by revealing the policy dividends of environmental tax through the financial market dimension of credit spreads. Second, it identifies heterogeneous policy effects across enterprise size and credit rating levels, deeply elucidating the micro-level mechanisms and conditional factors of environmental tax effectiveness.

2. Literature Review

2.1. Domestic and International Literature Studies

The economic effects of environmental regulation have long been a critical issue in the fields of environmental economics and corporate finance. Scholars from both domestic and international contexts have conducted extensive research from diverse perspectives, providing substantial evidence for understanding the interactions between policies and markets. The "Porter Hypothesis" lays a theoretical foundation for examining the innovation effects of environmental regulation, positing that well-designed environmental policies can stimulate corporate innovation, thereby partially or fully offsetting compliance costs [2].Building on this framework, some studies have begun to explore the relationship between environmental performance and financing costs. Effective environmental risk management can reduce corporate capital costs, as markets tend to perceive strong environmental performance as a signal of long-term operational stability [3].Firms with better environmental performance secure more favorable bank loan terms [4],indicating that environmental performance shapes debt financing costs by influencing perceived default risk. Existing literature has primarily focused on the impacts of environmental taxation on enterprise productivity and green innovation, while research on its mechanisms within debt markets remains relatively underexplored [5].

2.2. Summary of Literature

Current research on the economic impacts of environmental policies, both domestically and internationally, has primarily focused on the mechanisms through which environmental regulation influences corporate innovation behavior and productivity. Most studies have confirmed that well-designed environmental policies can stimulate corporate technological innovation and potentially enhance economic benefits. In recent years, some scholars have begun to explore the relationship between environmental performance and financing costs, finding that robust environmental management practices help reduce corporate capital costs. However, existing research still has notable limitations: first, there is insufficient exploration of the mechanisms through which environmental taxation—a critical policy tool—affects corporate debt financing costs; second, most studies emphasize the innovation effects of environmental regulation, with limited attention to financial market indicators, particularly credit spreads; lastly, discussions on the heterogeneity of policy effects across enterprises remain underdeveloped, and analyses of the underlying causes of such differences need strengthening. This study systematically examines the impact of environmental taxation on credit spreads, filling a critical gap in the literature. By

analyzing the heterogeneity of policy effects from the perspective of enterprise characteristics, it provides empirical support for refining environmental policy design and advancing green finance development.

3. Theoretical Analysis and Research Hypotheses

Hypothesis 1: The implementation of environmental protection tax reduces corporate credit spreads and lowers default risk.

The enactment of China's environmental protection tax law in 2018 created a favorable policy context for the healthy development of enterprises. As a market-based environmental regulation tool, the environmental protection tax internalizes environmental external costs, incentivizing enterprises to strengthen environmental governance and compliance efforts. By signaling positive information about enterprises' long-term operational stability to the market [6], the environmental protection tax reduces perceived default risk. Meanwhile, the risk compensation theory posits that improved environmental performance mitigates uncertainties such as environmental penalties and litigation, enhances cash flow stability, and thereby lowers the risk premium demanded in debt financing [3].

Hypothesis 2: the implementation of environmental protection tax is associated with corporate credit ratings and firm size.

There is significant heterogeneity in the behaviors and outcomes of enterprises in responding to environmental regulation. Larger-scale and higher-credit-rated enterprises typically possess more abundant financial resources, more comprehensive management systems, and stronger technological capabilities, enabling them to more effectively absorb the compliance costs imposed by environmental taxes and translate environmental protection investments into competitive advantages [7]. In contrast, small and medium-sized enterprises and lower-credit-rated enterprises face stricter financing constraints and higher adjustment costs, making their capacity to respond to environmental taxes and the effects of policy responses relatively weaker [8]. Therefore, the reductive effect of environmental taxes on credit spreads is expected to be more pronounced among higher-credit-rated and larger-scale enterprises.

4. Research Design

4.1. Model Specification

To investigate the impact of the Environmental Protection Tax Law implementation in 2018 on corporate credit spreads, following prior research methodologies, we employ a difference-in-differences (DID) model:

$$Y_{it} = \beta_0 + \beta_1 did_{it} + \gamma Controls_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

In the model, i and t represent firms and years, respectively. The dependent variable Y denotes green innovation capability, measured by the number of green patent applications. The core independent variable did is the interaction term $treat \times post$. Here, $treat$ is a group dummy variable (with 0 and 1 distinguishing low-pollution enterprises from high-pollution control groups), and $post$ is a time dummy variable indicating the implementation of the environmental protection tax in 2018. Control variables include indicators such as Lev and return on ROA , and μ represents the firm fixed effects. This paper focuses on the coefficient of the core independent variable. If the coefficient is positive, the implementation of the environmental protection tax has a positive impact on corporate innovation.

4.2. Sample Selection

This paper uses the number of green patent applications to represent enterprises' green innovation capability. We analyze firm data from A-share listed companies spanning 2009–2021. The data are sourced from annual reports, National Economic and Social Development Statistical Bulletins, and the CSMAR database. After removing outliers, dropping observations with missing values in key variables, and applying winsorization to extreme values, the final dataset is constructed for analysis.

4.3. Variable Selection

Table 1: Variable Definitions

Variable Symbol	Variable Name	Description
CS	Credit Spread	Yield to maturity of corporate bonds minus yield to maturity of government bonds with the same maturity.
post	Post-2018 Policy Implementation	Indicator variable marking the policy implementation timeline (2018 as the policy effective year).
treat	Treatment Group Indicator	Indicator distinguishing between high-pollution enterprises (treatment group) and others (control group).
did	Policy Effect (Interaction Term)	Core DID variable directly measuring the net policy effect
ROA	Return on Assets (ROA)	Measures a firm's ability to generate net profit using its total assets.
Lev	Asset-Liability Ratio (Lev)	Measures the proportion of a firm's assets financed by liabilities.

In Table 1: Variable Definitions, Variable is Defined.

5. Empirical Analysis

5.1. Descriptive Statistics Analysis

Table 2: Descriptive Statistics of Main Variables

Variable	Obs	Mean	Std. dev.	Min	Max
ROA	1735	0.0330497	0.1848289	-0.585995	7.445077
Lev	1735	0.56876	0.1458404	0.073005	0.987941
ln_cs	1735	0.5990716	0.6855846	-2.047055	1.924403
Size	1735	23.90988	1.460067	19.19794	28.63649
post	1735	0.2559078	0.4364961	0	1
treat	1735	0.167147	0.3732146	0	1
did	1735	0.0489914	0.2159122	0	1

In Table 2: Descriptive Statistics of Main Variables, the descriptive statistical results indicate a sample size of 1,735 observations. For key variables: the mean of ROA is approximately 0.033, with a standard deviation of 0.185, suggesting certain disparities in performance across enterprises. The mean of Lev is approximately 0.569, indicating that the average leverage level of the sample firms falls within a moderate range, and its standard deviation of 0.146 reflects limited variations in

capital structure among firms. The mean of $\ln_cs$ is 0.599, with a standard deviation of 0.686, revealing certain fluctuations in a specific characteristic of the enterprises. The mean of Size is approximately 23.91, with a standard deviation of 1.46, indicating that the sample firms are generally large in scale, with manageable individual differences. The mean of the interaction term did is 0.049, reflecting a low proportion of observations that are both in the treatment group and post-policy, which aligns with the common data structure in natural experiments or policy evaluations. The values of other control variables are distributed within reasonable ranges, with no obvious anomalies.

5.2. Regression Analysis

Table 3: Benchmark Regression Estimation Results

	$\ln_cs$	$\ln_cs$	$\ln_cs$
did	-0.223*	-0.204*	-0.203*
	(-2.21)	(-2.00)	(-2.01)
ROA		-1.847***	
		(-4.69)	
Lev			1.160***
			-4.14
$_cons$	0.606***	0.659***	-0.0515
	-125.98	-52.81	(-0.32)
Individual effect	Yes	Yes	Yes
Time effect	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Under controls for time and firm fixed effects, the regression results of the difference-in-differences (DID) model are presented in Table 3: Benchmark Regression Estimation Results. This section analyzes the impact of environmental taxation on corporate credit spreads. All three columns control for firm and time fixed effects, with control variables gradually incorporated. In the first column, which includes only the interaction term, the coefficient is -0.223 and statistically significant at the 5% level. This indicates that the implementation of the environmental tax policy significantly reduced corporate credit spreads, reflecting a decline in market-perceived default risk. This effect may be attributed to enhanced environmental compliance or improved operational stability driven by the policy. Columns 2 and 3 further introduce firm-specific financial characteristics: the coefficient for ROA is -1.847, significant at the 0.1% level, suggesting that higher profitability correlates with narrower credit spreads—a pattern consistent with the theoretical expectation that stronger financial robustness reduces risk premiums. Meanwhile, the coefficient for Lev is 1.160, significant at the 0.1% level, indicating that firms with higher leverage ratios exhibit wider credit spreads, aligning with capital structure theory. Collectively, these findings demonstrate that the 2018 environmental tax policy effectively reduced credit spreads for treated enterprises by enhancing their environmental compliance and long-term operational stability, thereby lowering default risk. Additionally, firm profitability and leverage remain critical determinants of credit spreads. For enterprises, improving profitability and optimizing capital structure are viable strategies to reduce financing costs and strengthen market confidence through proactive compliance with environmental policies. Regulators, in turn, should continue refining the environmental tax framework, clarifying policy expectations, and further leveraging its role in mitigating market risk perception.

5.3. Robustness Analysis

The conclusion is robust, as demonstrated by parallel trend tests, placebo tests, replacement of the dependent variable, and adjustments to the sample size. The government should adjust policies to guide corporate innovation and development.

5.3.1. Parallel Trends Test

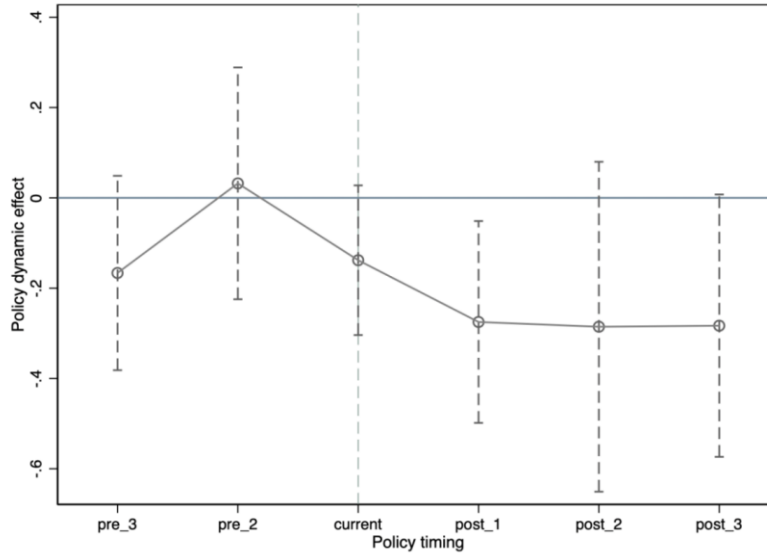


Figure 1: Parallel Trends Test

In Figure 1: Parallel Trends Test, the parallel trends test reveals that there were no significant differences in credit spreads between the treatment group and the control group prior to the policy implementation, satisfying the prerequisite for applying the difference-in-differences (DID) model. The dynamic path of policy effects indicates that the environmental tax significantly reduced corporate credit spreads in the current year of implementation and over the short term, suggesting that the market interpreted the policy as a positive signal, thereby lowering enterprise default risk and financing costs. However, this effect did not persist: in the second period after policy implementation and beyond, the impact became statistically insignificant. This implies that the inhibitory effect of the environmental tax on credit spreads is temporary. Potential explanations include the market fully digesting the policy information or long-term macroeconomic factors and enterprises' adaptive behaviors diluting the policy's standalone influence. While the environmental tax policy exerts significant short-term positive effects, its long-term impact is limited. To maintain sustained incentives, it is necessary to coordinate this policy with other regulatory tools.

5.3.2. Placebo Test

To rule out the interference of unobservable factors with the baseline findings, this paper conducts a placebo test. As shown in the Figure 2: Placebo Test, following multiple simulated sampling based on fictitious policy timings or fictitious treatment groups, the distribution of the resulting estimated coefficients is concentrated and tightly clustered around zero, with their kernel density curves resembling the shape of a normal distribution curve. More importantly, the p-values of the vast majority of fictitious estimates are greater than 0.1, which stands in sharp contrast to the significant negative effect observed in the baseline regression. This indicates that the "environmental tax reduces credit spreads" effect identified in the baseline regression is indeed

driven by the genuine environmental tax policy, rather than by other random factors or model specification errors. This test result provides strong empirical support for the reliability of the paper's core conclusions.

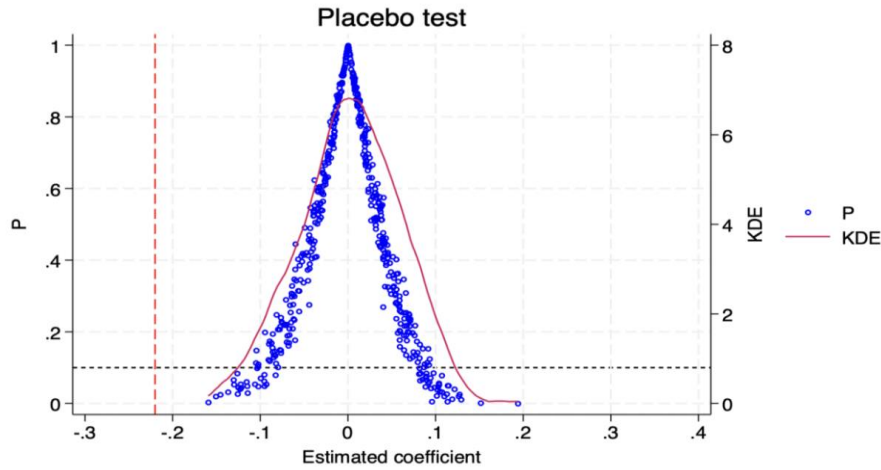


Figure 2: Placebo Test

5.3.3. Substituting the Dependent Variable

Table 4: Regression Results after Adjusting Sample Size

	ln_cs	ln_cs	ln_cs
did	-0.223*	-0.208*	-0.209*
	(-2.28)	(-2.12)	(-2.15)
ROA		-1.657***	
		(-3.62)	
Lev			0.949**
			-3.02
_cons	0.565***	0.613***	0.0284
	-107.83	-42.18	-0.16
Individual effect	Yes	Yes	Yes
Time effect	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

To further validate the robustness of our baseline findings, this paper conducts a robustness check by excluding the 2009–2012 sample. As shown in the Table 4: Regression Results After Adjusting Sample Size, after controlling for firm and time fixed effects, the coefficient of the key variable did remains statistically significant at the 5% level, indicating that the implementation of the environmental tax policy still significantly reduces corporate credit spreads—consistent with the baseline conclusions. Regarding control variables: ROA exhibits a significant negative correlation with credit spreads at the 1% level, suggesting that stronger profitability correlates with lower financing costs; Lev shows a significant positive correlation with credit spreads at the 1% level, aligning with the theoretical expectation that higher financial leverage corresponds to greater default risk. These results demonstrate that even after excluding the interference of samples from specific years, the core finding of this paper—that environmental taxation reduces corporate credit spreads—remains robust.

5.4. Heterogeneity Analysis

Table 5: Regression by Credit Rating Groups

	ln_cs	ln_cs
did	-0.143	-0.301**
	(-1.08)	(-2.66)
_cons	0.957***	0.173***
	-595.08	-16.03
Individual effect	Yes	Yes
Time effect	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 5: Regression by Credit Rating Groups, heterogeneity test results based on enterprise credit rating groupings reveal significant asymmetry in the impact of environmental tax policies on corporate credit spreads. In the subsample of higher-credit-rated enterprises, the coefficient of *did* is statistically significant at the 1% level, indicating that the environmental tax policy has led to a marked reduction in credit spreads for high-quality firms. By contrast, in the lower-credit-rating group, although the *did* coefficient remains negative, it fails to reach statistical significance, suggesting that the policy has limited effects on enterprises with weaker credit profiles. This finding carries important economic implications: High-credit-rated enterprises typically possess stronger capabilities in environmental compliance, more stable cash flows, and higher-quality information disclosure. These attributes enable them to better address the compliance pressures imposed by environmental tax policies, translate their environmental investments into reduced perceived risk, and ultimately secure lower financing costs [9]. Conversely, enterprises with lower credit ratings may face greater financial constraints and operational pressures, where the marginal cost of environmental compliance is higher. These firms struggle to significantly boost market confidence in the short term, resulting in insignificant policy effects. Overall, the test results demonstrate that the impact of environmental tax policies on enterprise financing costs is significantly moderated by firm credit quality, with more pronounced effects observed among high-quality enterprises.

Table 6: Regression by Firm Size Groups

	ln_cs	ln_cs
did	0.148	-0.276*
	-0.55	(-2.48)
_cons	0.775***	0.392***
	-186.79	-40.25
N	909	731
Individual effect	Yes	Yes
Time effect	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 6: Regression by Firm Size Groups, heterogeneity test results based on firm size groupings reveal significant discrepancies in the impact of environmental tax policies on corporate credit spreads across different firm sizes. In the large-firm subgroup, the coefficient of *did* is statistically significant at the 5% level, indicating that the environmental tax policy has notably reduced credit spreads for large enterprises. Conversely, in the small-firm subgroup, the *did* coefficient is positive but fails to reach statistical significance, suggesting that the policy has not mitigated financing costs for micro and small enterprises—in fact, it may even have exerted slight upward pressure. This finding aligns with the scale effect theory: Large firms typically possess

stronger capital endowments, more advanced environmental protection facilities, and more mature green transformation capabilities. These advantages enable them to absorb environmental tax costs through economies of scale, transform environmental investments into reduced compliance risks and enhanced market reputations, and ultimately secure financing advantages. In contrast, micro and small enterprises face higher marginal compliance costs and tighter financing constraints. Environmental taxes may exacerbate their financial burdens, making it difficult to achieve measurable improvements in credit ratings in the short term. Collectively, these results demonstrate that the effect of environmental tax policies on enterprise financing costs is significantly moderated by firm size, with more pronounced and positive impacts observed among large enterprises.

6. Conclusions and Policy Recommendations

6.1. Conclusions

This study takes the implementation of China's Environmental Protection Tax Law in 2018 as a natural experiment and systematically examines the policy effects and mechanisms of environmental taxation on corporate credit spreads using a multi-period difference-in-differences (DID) model. The findings indicate that the implementation of the environmental tax significantly reduced corporate credit spreads, suggesting that its positive environmental governance signals strengthened market confidence and lowered debt financing costs. Heterogeneity analysis further reveals that the policy had more pronounced effects on larger and better-credit-quality enterprises, reflecting structural disparities in the policy's impacts. Overall, the environmental tax not only promotes enterprise environmental investment and compliance but also improves the financing environment for enterprises in the debt market to a certain extent.

6.2. Recommendations

1) Enhance the specificity and adaptability of environmental tax policy design. Classified management could be implemented based on enterprises' environmental performance, industry characteristics, and size differences. Measures such as dynamic tax rate mechanisms or tax relief policies could alleviate the burden on small but environmentally compliant enterprises, preventing market unfair competition caused by uneven policy enforcement.

2) Advance the integration of environmental governance and financial market mechanisms. Explore linking enterprise environmental credit evaluations to financing conditions, encouraging banks and financial institutions to provide preferential credit support to green and low-carbon enterprises, and expanding financing channels such as green bonds and sustainability-linked loans. This would establish a market-oriented incentive system grounded in green credit.

3) Strengthen comprehensive support for enterprise green transformation. Enterprises should proactively integrate environmental compliance and carbon emission reduction into their strategic planning, enhancing green competitiveness through technological upgrading and innovation. Governments could consider establishing green transformation funds to provide technology subsidies and tax credits to eligible enterprises, reducing their environmental compliance costs and achieving synergistic development between environmental protection and economic efficiency.

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