The Impact of Environmental Protection Fee-to-tax Reform on Corporate ESG Performance — an Empirical Study Based on the Difference of Tax Burden Upgrading

Han Zhang

University of Shanghai for Science and Technology, Shanghai, China

Abstract: Taking the implementation of the Environmental Protection Tax Act in 2018 as an opportunity, based on a quasi-natural experiment on differences in tax increase quotas, this paper analyzes the differences in tax increase quotas using a double difference model to examine the impact of environmental protection tax policies on corporate ESG performance. Based on data from A-shared manufacturing companies listed in our country from 2012-2024, this paper finds that environmental tax reform significantly improved corporate ESG performance. Further research shows that both low-level and high-level tax increase quotas can promote corporate ESG performance, while there are "policy blind spots" in middle-level tax increase quotas. Heterogeneity analysis shows that there are significant differences in corporate ESG performance depending on corporate pollution levels.

Keywords: environmental protection fee to tax; tax burden upgrading difference; difference-in-difference model

1. Introduction

In response to environmental pressures brought about by industrialization and urbanization, China switched from waste fees to environmental protection taxes. The old tax system had issues such as low legal status, weak enforcement, local intervention, and low tax rates, leading to companies simply paying instead of reducing emissions. The Environmental Protection Tax Act, officially implemented in 20168, introduced mandatory taxation by tax authorities, improving the authority and efficiency of taxation. In the context of global ESG concerns, corporate ESG performance now reflects long-term value, with environmental regulation being a key driver. Therefore, it is crucial to study the impact of this policy shift on ESG.

Existing research is mainly based on the framework of sustainable development theory and stakeholder theory[1-3], and recognizes that corporate ESG performance is influenced by internal governance structure[4-5] and external institutional environment[6-8]. The environmental protection fee-to-tax policy follows the Pigovian Tax principle, and realizes the internalization of the negative externality of the environment by transforming the sewage fee into an environmental protection tax with more legal rigidity and enforcement force[9-10].

Regional development disparities in China necessitate tailored environmental policies. The environmental protection tax grants provincial governments discretion to set differentiated rates based on local conditions — for instance, higher rates in Beijing and Shanghai versus lower rates in central and western regions. This design offers a research window into heterogeneous corporate responses to policy intensity changes. Table 1 presents province-specific collection standards and sample groups.

Table 1. Provincial Environmental Tax Standards and Sample Groups

Type	Provinces	Air pollutants	Water pollutants
Tax Burden Filing	Beijing	12	14
	Hebei	No. 1:9.6 for major pollutants, 4.8 for others Tier 2: major pollutants 6, other 4.8 Third: 4.8	Tier 1: Major Pollutants 11.2, others 5.6 Step 2: Major Pollutant 7, other 5.6 Third: 5.6
	Jiangsu	Nanjing 8.4, Wuxi, Changzhou, Suzhou, Zhenjiang 6, rest of China 4.8	Nanjing 8.4, Wuxi, Changzhou, Suzhou, Zhenjiang 7, rest of China 5.6
	Shandong	Sulfur dioxide, nitrogen oxides 6, others 1.2	5 heavy metals, chemical oxygen demand, ammonia nitrogen 3, other 1.4
	Hunan, Henan	4.8	5.6
	Chongqing	3.5	3.0
	Sichuan	3.9	2.8

Type	Provinces	Air pollutants	Water pollutants
Tax Burden Translation	Guizhou, Hainan	2.4	2.8
	Guangxi	1.8	2.8
	Shanxi	1.8	2.1
	Tianjin	Nitrogen Oxides 8, sulphur dioxide, soot, general dust 6, others 1.2	Chemical oxygen demand, ammonia nitrogen 7.5, others 1.4
	Shanghai	2018: sulfur dioxide 6.65, nitrogen oxides 7.6, others 1.2 2019: Sulfur Dioxide 7.6, Nitrogen Oxides 7.6, others 1.2	Chemical oxygen demand 5, ammonia nitrogen 74.8, others 1.4
	Zhejiang	1.8 for 4 heavy metals, 1.2 for others	5 heavy metals 1.8, other 1.4
	Fujian	1.2	5 heavy metals, chemical oxygen demand, ammonia nitrogen 1.5, other 1.4
	Hubei	Sulfur dioxide, nitrogen oxides 2.4, others 1.2	5 heavy metals, chemical oxygen demand, total phosphorus, ammonia nitrogen 2.8, other 1.4
	Yunnan	January 2,2018; February 8,2019	1.4 in 2018,3.5 in 2019
	Liaoning	2018-2019 January 2,2020 sulfur dioxide, nitrogen oxides 2.4, other 1.2	2018-2019:1.4; 2020:2.8 for chemical oxygen demand and ammonia nitrogen; 1.4 for other pollutants
	Guangdong	1.8	2.8
	Others	1.2	1.4

The marginal contribution of this paper consists of two aspects. First, introducing differences in environmental tax burden increases into the analysis reveals the nonlinear threshold effects of regulatory intensity on corporate ESG behavior, deepening the Porter hypothesis. Second, by dynamically weighting the China securities and Bloomberg ESG data, constructing an evaluation system with local adaptability and international comparability.

2. Theoretical hypothesis

Hypothesis 1: the introduction of environmental protection tax can improve the ESG performance of manufacturing enterprises.

Hypothesis 2: After the environmental protection tax law, both low and high tax bracket levels significantly improved manufacturing firms' ESG performance, while medium-level bracketing showed no significant effect.

3. Research design

3.1 Sample selection

This study uses 2012–2024 Shanghai and Shenzhen A-share manufacturing listed companies as the initial sample. Following academic conventions, we excluded firms flagged as ST, *ST, or PT, those with insolvency (liabilities > assets), and observations with missing core variables. All continuous variables were winsorized at the 5% and 95% levels to enhance robustness.

Key variables are defined as follows: Treat equals 1 for firms registered in 12 provinces (Guizhou, Hainan, Guangxi, Shanxi, Beijing, Hebei, Henan, Chongqing, Jiangsu, Shandong, Hunan, Sichuan) and 0 otherwise. Post equals 1 for years 2018 and after, and 0 otherwise. The interaction term did (Treat × Post) captures the policy's treatment effect.

3.2 Variables and models

This study uses the 2018 Environmental Protection Tax Act as a natural experiment to assess the impact of tax changes on ESG performance using a DID model:

$$ESG_{it} = \beta_0 + \beta_1 did_{it} + \beta_x X_{it} + \lambda_r + \mu_t + \vartheta_j + \varepsilon_{it} \quad (1)$$

Where: β_1 is the estimation coefficient that is primarily of interest in this study, representing the net effect of environmental cost-revision taxes on the ESG performance of the company; β_x is the effect set of each control variable; X_{it} is a set of control variables that may affect the ESG performance of the company; $\lambda_r, \mu_t and \vartheta_j$ are the fixed effects of the region, year, and industry, respectively; ε_{it} is the random perturbation term.

Each variable as shown in the table2.

Table 2. Variable indicator

Type of variable	Symbol	Definition
Explained variable,	ESG	Huazheng ESG Rating Score
Explaining variable	DID	Interaction Terms of Policy Virtual Variable and Time Virtual Variable
Controlled variable	SIZE	natural logarithm of total annual assets
	LEV	Total liabilities at year-end / Total assets at year-end
	GROSSPROFIT	(Operating revenue-Cost of sales) / Operating revenue
	NETPROFIT	net profit/operating revenue
	TANGIBLE	Total Assets-Net Intangible Assets-Net Goodwill / Total Assets
	GROWTH	Current year's operating revenue minus the previous year's operating revenue
	FL	Net profit plus income tax expense plus financial expense divided by net profit plus income tax expense

3.3 Descriptive statistical analysis

Table 3 reports over 27,000 observations. The mean ESG score is 73.119 (SD=4.607). The policy variable did averages 0.271, supporting the DID design.

Table 3. Descriptive analysis

	①	②	③	④	⑤
Variables	Count	Mean	SD	Min	Max
ESG score	27347	73.11	4.60	63.81	81.45
Policy effects	27347	0.27	0.44	0.00	1.00
Firm size	27347	22.07	1.17	19.52	26.45
Ratio of assets to liabilities	27347	0.38	0.19	0.03	0.91
Gross margin on sales	27347	0.29	0.17	-0.06	0.87
Proportion of tangible assets	27347	0.93	0.06	0.44	1.00
Growth rate of operating income	27347	0.12	0.34	-0.67	5.07
Financial leverage	27347	1.18	0.90	-2.02	11.55
NET rate of return on sales	27347	0.06	0.18	-2.11	0.54

4. Empirical results

4.1 Basic regression results

Table 4 shows the environmental protection fee-to-tax policy (did) positively affects ESG performance across all three models. As firm-level controls and fixed effects are added, the did coefficient declines but remains significant at 5% or 10% levels, confirming the policy's robust positive impact on manufacturing firms' ESG.

Table 4. The results of the benchmark regression

	①	②	③
Did	0.307^{**}	0.218^{*}	0.196^{*}
	(3.03)	(2.23)	(1.98)
Constant term	73.044^{***}	38.223^{***}	38.473^{***}
	(2636.32)	(5.61)	(5.71)
Control Variables	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes
Clustering to industry	No	No	Yes
Observations	27347	27347	27347
R squared	0.50	0.51	0.51

4.2 Parallel trend test

The parallel trend test validated the DID model. As shown in Figure 1, ESG performance before the policy did not differ significantly between the groups, meeting the parallel trend hypothesis. After the policy, ESG followed the "short-term peak - mid-term retraction - long-term rebound" path: short-term effect significant peak; mid-term coefficient decrease, indicating adjustment pressure; long-term coefficient increase, indicating institutional dividends when ESG was internalized as strategy. These results validated the model's validity and supported further mechanism analysis.

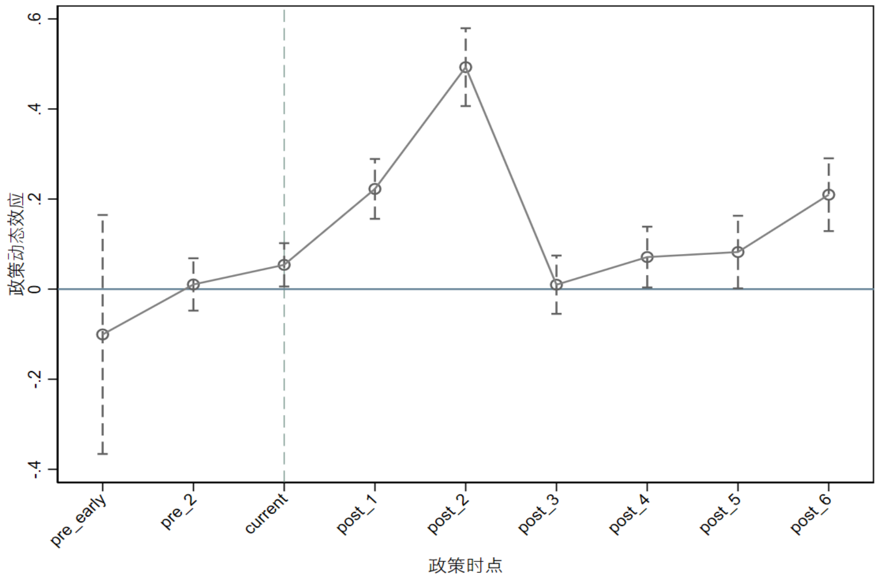

Figure 1. Parallel trend test

4.3 Robustness test

4.3.1 Replacement of explained variables

To enhance robustness, we constructed a comprehensive ESG indicator by converting Huazheng and Bloomberg ESG scores into percentile rankings and averaging them, eliminating metric differences. As shown in Table 5, the core conclusion remains significant using either Bloomberg ESG or the weighted indicator, confirming that Tariff and tax reforms can improve ESG performance of manufacturing companies.

Table 5. Regression results with replacement of explained variables

	①	②	③	④
	Bloomberg ESG	Bloomberg ESG	Weighted ESG	Weighted ESG
Did	9.961***	4.577***	0.185**	0.086***
	(4.02)	(3.99)	(5.67)	(6.76)
Constant term	30.406**	-199.069***	0.498***	-3.668***
	(23.43)	(-8.51)	(24.81)	(-10.72)
Control Variables	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	6517	6517	6517	6517
R squared	0.543	0.694	0.588	0.691

4.3.2 Exclusion of interference from relevant policies

In order to eliminate the potential interference of other contemporaneous environmental policies on the research conclusions, this study conducts a series of robustness tests, and the results show that: The impacts of major environmental policies, such as Low-carbon city pilots in 2012 and 2017, energy conservation and emission reduction policies in 2015, "Waste-free city" construction pilots in 2019, Sichuan ecological environment construction pilots in 2021, and regional reclaimed water recycling pilot in 2022, were controlled. As shown in table 6, the coefficient of the core explanatory variable DID is consistently significantly positive at the level of 5% or 1% after controlling for the above policies in order and maintaining firm, year, and region fixed effects, estimates range from 0.302 to 0.341. This result strongly indicates that the promotion effect of the environmental protection fee-to-tax policy on corporate ESG performance through the difference in tax burden upgrading is independent and robust, and is not driven by other relevant environmental policies. The r-square value of the model is stable at about 0.50, which further confirms the validity of the model setting, thus enhancing the reliability of the core conclusions of this study. This shows that after excluding the impact of relevant policies, the environmental protection fee-to-tax reform can still significantly improve the ESG performance of enterprises, which is consistent with the conclusion of the benchmark study.

Table 6. Results of exclusion of relevant policy interference

	①	②	③	④	⑤	⑥
	2012 low-carbon pilot	2017 low-carbon pilots	2015 Energy saving and emission reduction in	2019 no-waste cities	2021 Sichuan ecological environment construction pilot	2022 regional reclaimed water cycle
DID	325 ***	0.341 ***	0.302 ***	0.309 *	0.309 *	0.308 *
	(3.18)	(3.20)	(3.10)	(3.02)	(3.05)	(3.02)
Constant term	73.031 **	73.032 ***	73.046 ***	73.044 ***	73.043 ***	73.040 ***
	(2585.53)	(2480.70)	(2743.90)	(2604.94)	(2647.63)	(2630.89)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustering to year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19732	18222	17030	14056	17084	16413
Adjust for R squared	0.502	0.502	0.500	0.500	0.500	0.500

5. The analysis of tax burden classification results

5.1 Classification of environmental tax burden

This study further divides the policy impact of environmental protection fees into tax shocks, and examines the heterogeneous impact of different degrees of tax burden upgrading on corporate ESG performance.

The amount of tax submission in the areas after tax modification of environmental expenses was sorted by high and low. For example, air pollutants had a maximum of 8.4 and a minimum of 0.6, and by dividing the difference into three equal parts, we obtained quantile points 3.2 and 5.8. According to this, we divided high [5.8, 8.4], medium (3.2, 5.8), and low (0.6, 3.2) into three grades, and constructed virtual variables G, Z, and D. Water pollutants were treated similarly, and the various grades of variables were incorporated into the model regression. The results are shown in Table 7.

Research shows environmental taxation has a nonlinear threshold effect on ESG performance: low taxation stimulates marginal green improvements; medium taxation falls into a “policy blind zone,” showing no effect on air pollution and even negatively impacting water pollution; high taxation drives systematic green transformation, yielding significant positive effects.

Table 7. Results of environmental tax burden classification

	①	②
	Per equivalent of air pollutants The standard is the amount of tax increase	Per unit volume of water pollutants The standard is the amount of tax increase
Didd	0.776 **	0.531 ***
	(3.61)	(4.39)

	①	②
Didz	-0.059	-0.216
	(-0.50)	(-1.74)
Didg	0.462 *	0.463 *
	(1.96)	(1.96)
Constant term	38.205 * * *	38.254 * * *
	(5.62)	(5.62)
Control Variables	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effect	Yes	Yes
Observations	27347	27347
R squared	0.513	0.513

5.2 Tax Burden classification and heterogeneity

5.2.1 Heterogeneity in the degree of contamination

Table 8 shows that the incentive effect of environmental tax differentiation tax burdens is heterogeneous in the level of pollution. Both low and high tax rates can significantly motivate non-heavy-polluting companies to reduce emissions, but the incentive effect is weaker for heavy-polluting companies. The overall effect of medium tax rates is poor, even producing a significant inhibitory effect on heavy-polluting water pollutants, indicating that heavy-polluting companies have lower sensitivity to tax burdens, and medium tax burdens may be counterproductive.

Table 8. Results of heterogeneity of pollution degree

	①	②	③	④
	Air pollutants Not heavy pollution	Air pollutants Heavy pollution	Water pollutants Not heavy pollution	Water pollutants Heavy pollution
Didd	1.011 * *	0.231	0.732 * * *	358 *
	(4.26)	(0.89)	(4.67)	(1.99)
Didz	0.132	-0.219	0.021	- 0.643 *
	(0.59)	(-0.95)	(0.10)	(-1.99)
Didg	0.460 *	0.016	0.460 *	0.019
	(2.05)	(0.04)	(2.06)	(0.05)
Constant term	35.738 * * *	42.189 * * *	35.800 * * *	42.328 * *
	(4.81)	(7.31)	(4.81)	(7.31)
Control Variables	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	20118	7229	20118	7229
R squared	0.528	0.516	0.528	0.516

5.2.2 Regional heterogeneity

This heterogeneity analysis shows that there are significant North-South differences in the impact of environmental fees and tax changes on corporate ESG performance. It can be seen from Table 9 that in the low-emission group, southern companies were highly sensitive to policy, with their air and water pollutants having DDD coefficients of 0.927 and being significant at the 1% level. Entering the medium-elevation group, the response of southern companies shifted, with the DDZ coefficients both being -0.349 and significantly negative at the 5% level, indicating that medium-intensity tax burdens instead triggered their strategic behavior to achieve emissions reductions through efficiency enhancements or strategic adjustments; while northern companies coefficients, although turning positive (atmosphere 0.205, water 0.319), remained insignificant, continuing the characteristics of slow response. In the high-elevation group, coefficients on both sides failed the significance test (south -0.747, north 0.587), indicating that extremely high-intensity regulations tend to blur policy-driven effects, with southern companies entering a strategic observation period, while northern companies are constrained by industry rigidity and enforcement constraints. In conclusion, the effects of environmental policy take different paths depending on the regional economic structure, market environment, and enforcement intensity. It is difficult for a single policy to achieve the expected effects.

Table 9. Regional heterogeneity results

	①	②	③	④
	Air pollutants	Air pollutants	Water pollutants	Water pollutants
	South	North	South	North
Didd	0.927***	-0.251	0.927***	0.113
	(4.49)	(-0.58)	(4.49)	(0.79)
Didz	-0.349*	0.205	-0.349*	0.319
	(-2.13)	(1.16)	(-2.13)	(1.00)
Didg	-0.747	0.587	-0.747	0.586
	(-1.19)	(1.78)	(-1.19)	(1.77)
Constant term	37.463**	38.873***	37.463**	38.868***
	(4.89)	(6.53)	(4.89)	(6.55)
Control Variables	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Clustering to year	Yes	Yes	Yes	Yes
Observations	20035	7312	20035	7312
Adjust for R squared	0.510	0.526	0.510	0.526

6. Conclusions and suggestions

The study finds that environmental taxes promote corporate ESG performance, exhibiting a non-linear "both ends effective, mid-point ineffective" threshold effect: low taxes spur marginal improvements, high taxes drive deep strategic shifts, while mid-level taxes fall into an "incentive blind spot" due to insufficient cost pressure, potentially causing short-term avoidance. Robustness checks confirm the findings.

Three policy insights emerge: 1) Design precise, dynamically adjusted tax rates based on industry and regional differences; 2) Firms should treat environmental compliance as a long-term strategy, using ESG to build competitiveness; 3) Strengthen mandatory ESG disclosure and promote multi-stakeholder governance to align high-quality development with environmental goals.

References

[1] Bansal, p.,&Song,H.C.(2017). "Similar but Not the Same: Differentiating Corporate Sustainability from Corporate responsibility." Academy of Management Annals, 11(1), 105-149.

[2] Donaldson, T., & Preston, L. E. (1995). "The Stakeholder Theory of The Corporation: Concepts, Evidence, and implications" Academy of Management Review, 20(1), 65-91.

[3] Hart, s. L. 1995). "A Natural-Resource-Based resource-based view of Management Review, 20(4), 986-1014.

[4] Ferrell, A., Liang, H., & Renneboog, L. (2016). "Socially Responsible firms." Journal of Financial Economics, 122(3), 585-606.

[5] P Velte. Women on Management Board and ESG performance [J].Journal of Global Responsibility, 2016,7(1): 98-109.

[6] Haijing Cai, zhenying Zhou. Market-oriented environmental regulation policy and the quality of ESG Information Disclosure [J]. Journal of Finance and Accounting, 2022, (24): 62-70.

[7] Delmas, M., & Toffel, M. W. (2008). Organizational responses to environmental demands: Opening the black box. Strategic Management Journal, 29(10), 1027-1055.

[8] Li Xiaojing, Li Kexin. Can family involvement improve corporate ESG performance based on socioemotional wealth theory. Journal of Finance and Accounting, 2022, (17): 151-160.

[9] Cao Jingtao. From the Pigou tax effectiveness to see our country environmental protection fee to tax [J]. Tax Research, 2016, (04): 37-41.

[10] Chen Shaoying. Legislative Choices for Converting Environmental Pollution Discharge Fees to Taxes: A Reconsideration Based on the Essence of Taxation[J]. Journal of East China University of Science and Technology (Social Sciences Edition), 2016,31(01):108-116+132.