RESEARCH-ARTICLE

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The Impact of China's New Environmental Protection Law on Firm-Level Capital Expenditure

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Abstract

This study seeks to analyze the impact of the new Environmental Protection Law (EPL) on corporate expenditures in China. Using the Chinese A-share listed firm from 2012-2019, we find that the application of the EPL had a significant adverse effect on enterprises' expenditures. Private enterprises showed that the impact of the EPL on investment in fixed assets and other long-term assets was not significant in the first phase of the law's implementation, but after the implementation of the law, the enterprises significantly reduced their capital expenditures (Capex.). Whether it is a public or private labor-intensive or non-labor-intensive enterprise, the expenditure is adversely affected, both before and after the Environmental Protection Law's enactment. The panel data analysis and multivariate regression and PSM-DID method are used to verify our results, and the robustness of the conclusion is proven.

CCS Concepts

• **Applied computing** → Law, social and behavioral sciences .

Keywords

Environmental Protection Law (EPL), Corporate Investment, State-Owned Enterprises (SOEs)

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1 Introduction

Environmental regulations strikingly differ among countries [1]. Environmental conservation and economic development have advanced concurrently in China since the country's reform and opening in 1978; nonetheless, the contributions to environmental protection seem to be smaller than those to economic growth [2]. The fundamental environmental protection law (EPL) of China, guiding the green development of economy, was first promulgated in 1989 and revised in 2014. In the 14th five-year plan (2021-2025) and the outline of long-term objectives for 2035, the new vision of EPL 2035 is proposed. The new 5-year plan indicates that because of the broad adoption of green manufacturing and lifestyle practices, carbon emissions have been steadily declining since their peak. With this shift, the natural environment has been significantly improved, which has helped China go closer to realizing its vision of a beautiful and sustainable future.

Economists are paying more attention to changes in political or economic policies because they make economic actors unsure about whether and how government actions might change current policies, which could cause swings in the economy. Especially, the major decision-making and behavior of investment, will be significantly affected [3]. The new Environmental Protection Law's economic effects have been the subject of several recent studies. Investors may become less eager to invest in highly polluting companies when new environmental policies are revealed because they expect that these companies will face consequences [4]. However, there is no unified conclusion on this effect [3]. Meanwhile, the mechanism of this effect is also controversial. Therefore, it is essential to examine how environmental policy affects corporate investment and to understand the underlying mechanisms influencing this relationship. Previous research has overlooked the fact that cash inflows and outflows are the elements that determine corporate funding. Many scholars have researched how environmental restrictions influence economic growth and employment; however, few have explored the impact of these regulations on company investment in China, by strengthening environmental protection as a key content of ecological civilization construction.

Our paper has three contributions to literature.

First, our research enriches the knowledge regarding the new Environmental Protection Law's economic effects. Previous studies have mostly looked at how the EPL affects energy efficiency and emission reduction with an emphasis on a macroeconomic standpoint. We examine the investment activities of enterprises to EPL from the micro perspective.

Second, our study provides a new interpretation for the slowdown of Chinese economic growth. This paper gives a possible explanation from the perspective of EPL, which causes the heavier burden and lower investment of enterprises.

Third, we provide fresh data suggesting that China's state-owned firms' low efficiency stems mostly from their emphasis on achieving social objectives and taking on social duties.

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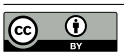

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2 Theoretical analysis and research hypotheses

2.1 The environmental regulation enforcement and the investment of enterprises

investigated the water pollution control measures in China's eleventh five-year plan and discovered that while environmental regulations increased investments in environmental protection among major pollutant discharging enterprises [5] , they also caused these enterprises to relocate to areas with laxer environmental regulations. Corporate investment preferences and the choice of investment locations are influenced by environmental legislation, according to some research that concentrates on export and human capital investment [6–8]. A recent study by found a reverse U-shaped association between corporate green investment and environmental control policies, utilizing data from Chinese listed businesses between 2008 and 2016.

It gets progressively more difficult to get businesses to engage in environmental governance, especially when the marginal revenue from it is less than the marginal expense. However, the implementation of the new EPL will increase the punishment for illegal pollutant discharge enterprises, which may lead to more losses caused by environmental violations than the governance cost for the environment. For the sake of cost minimization, enterprises are more likely to achieve compliance by suspending some production activities or investments. Clearly, the enforcement of the new EPL in 2014 has changed the situations around the firms and hence affected the investment of enterprises. The influence of investment costs related to preservation of the environment is mainly shown in two areas: the increasing prices that businesses bear for environmental preservation and the growing expenses linked to breaking laws and regulations. If the situation is grave it has to be brought to the attention of the people's government for approval. An order to close the plant or cease operations can follow. These measures indirectly lead to the reduction of the production of the firms related and further the investment of enterprises. The regulations on the emission standards and total emission of enterprises and institutions in the EPL reduce the flexibility of production arrangement of enterprises. Thus, we based the above discussion and make the following Hypothesizes:

H1: All businesses' investment operations are severely impacted by Environmental Protection Law's enforcement.

2.2 The environmental policy and the investment behavior in different firm-ownership

SOEs with government background are more willing to incorporate environmental issues into corporate strategies. This strategy can be regarded to improve the consistency between the environmental pollution problems of the company and the expectations of the government find that political relationships have a positive impact on corporate environmental responsibility [9]. Most SOEs have direct connections with the local government, and political connections help enterprises obtain government subsidies, subsidies and tax cuts related to environmental protection. Political ties may act as an umbrella to help enterprises escape corporate environmental responsibility.

Managers are unwilling to bear expenses without direct financial benefits, so they usually focus on investments in the short term that can maximize their reputation and the benefits they can get. These characteristics make it difficult for risk averse managers to accept environmental initiatives at the beginning. In the short run, investments in environmental preservation can have higher private costs than benefits, and enterprises often do not take the initiative to take part in environmental governance. But the implementation of EPL requires enterprises to make a lot of investment in the redesign of production process, investment in new equipment and employment of technicians, and only over an extended period may the rewards on investment be recognized.

For private enterprises, in the initial stage, without the administrative pressure of the government, they will gradually follow the legal requirements of emission reduction and energy saving in order to lessen pollution. However, once the law comes into effect, the relationship between private enterprises and the government is weaker than that of SOEs, in order to avoid being punished more in environmental protection, they will increase green technology R&D expenditures, increase the intensity of decrease in emissions and preservation of energy. As a result, we suggest making the following assumption:

H2: The EPL has no significant initial impact on private companies' investment, but it has a negative impact in the long run.

3 Research Design

3.1 Model construction

Corporate investment empirical research suggests that firm cash flow is a useful predictor of investment choices. This is explained by a number of financial market frictions, such as unfavorable selection brought on by information asymmetry and credit rationing [9]. As a result, businesses experience more financial limitations as borrowing prices rise, which increases their dependence on internal cash flow to guide investment decisions.

Here, the superscript k refers to the various Investment measures in the article. The company's investment can be based on the company's actual investment cash flow in 2012-2019(InvestmentitK), In terms of the EPL's implementation, it affects the investment of enterprises in many aspects. The investment of an enterprise is affected by capital expenditures and expectation. The income and investment cost are reflected in the financial status (Ci), sales revenue (Ti), enterprise size (Si), corporate governance (Gi), etc; In addition to these reasons, there are investment kit and dummy variable (D), such as fixed effect of enterprise itself and industry. It is expressed by formulas.

$$nvestment_{it}^{k} = f\left(C_i, T_i, S_i, G_i, Investment_{it-n}^{k}, D\right) \tag{1}$$

The regression equation of corporate investment is set as follows:

$$Investment_{it}^{k} = \alpha + \beta_1 Environ_law_{it} + \beta_2 Environ_law_{it} * private_{it} + \beta_3 Post_law_{it} + \beta_4 Post_law_{it} * private_{it} + \beta_5 X_{it} + \varepsilon_{it}. \tag{2}$$

In the equation, Invesmentitk is the variable, indicating the level of the investment. According to relevant research (Duchin et al., 2010; Roberto Alvarez et al., 2018), this research uses three variables to define corporate investment: Invest_Aand Invest_B.

Table 1: List of variables used in main analysis.

Variable Definitions
Dependent variables:
Invest A = log(1+cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets)
Invest_B = log(1+cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets + cash paid for investment in the other firms + net cash paid for acquisition of subsidiaries and other business units + cash paid for other investment activities)
Explanatory Variables
Environ_lawit =1 for the years 2013-2015, otherwise it is 0. Representing the early stage of the implementation of the environmental protection law.
Post_lawit =1 for 2016-2018, otherwise it was 0. Representing the the later stage of the implementation of the environmental protection law.
Privateit =1 for the value of private ownership enterprise, otherwise it is 0. it is a dummy variable of enterprise property right.
Control Variables:
Size=natural logarithm of the company's total assets.
Leverage =total liabilities/total assets of a company.
Growth = the sales growth rate
Cash=cash flow generated from main operation activities/ beginning balance of total assets
ROA = Net profit for the period/beginning balance of total assets
Bigholder=Shareholding ratio of the biggest shareholders.

Table 2: The Baseline Regression-EPL,Ownership and Corporate Investment

	(1) Invest_A	(2) Invest_A	(3) Invest_B	(4) Invest_B
Environ_Law	-.304***	-.283***	.082***	.044
	(.021)	(.028)	(.026)	(.034)
Post_Law	-.592***	-.54***	.113***	.044
	(.033)	(.038)	(.042)	(.047)
Environ_Law*private		-.053		.087*
		(.039)		(.045)
Post_Law*private		-.128***		.165***
		(.048)		(.057)
Size	1.073***	1.082***	1.241***	1.23***
	(.034)	(.034)	(.036)	(.036)
Leverage	-.004***	-.003***	-.018***	-.018***
	(.001)	(.001)	(.001)	(.001)
ROA	.01***	.01***	.009***	.009***
	(.002)	(.002)	(.002)	(.002)
Salegrowth	-.001***	-.001***	.001**	.001**
	(0)	(0)	(0)	(0)
Lnage				
Bigholder	.008***	.008***	.001	.001
	(.002)	(.002)	(.002)	(.002)
Cashs	-.414***	-.459***	-2.007***	-1.95***
	(.117)	(.119)	(.161)	(.164)
_Cons	-3.955***	-4.007***	-3.56***	-3.501***
	(.286)	(.288)	(.299)	(.301)
Observations	16136	16136	16134	16134
R-squared	.258	.258	.347	.348

Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.1

Table 3: EPL, Ownership, and Investments based on Labor-Intensiveness.

	Labor-intensive firms		Non-labor-intensive firms	
	(1)	(2)	(3)	(4)
	InvestA	**InvestB**	**InvestA**	**InvestB**
Environ_Law	-.238***	.031	-.282***	.039
	(.037)	(.046)	(.05)	(.061)
Environ_Law*Private	-.087*	.014	-.068	.219**
	(.047)	(.058)	(.075)	(.089)
Post_Law	-.549***	.048	-.472***	.051
	(.048)	(.068)	(.068)	(.078)
Post_Law*Private	-.098*	-.013	-.158*	.308***
	(.059)	(.078)	(.091)	(.108)
Size	1.176***	1.335***	1.07***	1.249***
	(.046)	(.052)	(.062)	(.068)
Leverage	-.004**	-.019***	-.003	-.016***
	(.002)	(.002)	(.002)	(.003)
ROA	.006***	.005*	.01***	.007**
	(.002)	(.003)	(.003)	(.003)
Salegrowth	0	.001**	-.001***	0
	(0)	(0)	(0)	(0)
Bigholder	.008***	.006**	.005	.002
	(.002)	(.003)	(.003)	(.004)
Cash	-.426***	-2.32***	-.331*	-1.703***
	(.144)	(.194)	(.2)	(.324)
_Cons	-4.452***	-4.16***	-4.252***	-4.054***
	(.365)	(.402)	(.543)	(.592)
Observations	7343	7343	7234	7232
R-squared	.275	.338	.183	.255

*Standard errors are in parentheses;*** p<.01, ** p<.05, * p<.1*

A dummy variable called $Environ\_law_{it}$ stands for the first phase of the EPL's implementation. It is 1 for the years 2013-2015, it is 0 for other years. At a later version of the EPL's implementation, $Post\_law_{it}$ is a dummy variable. It was 1 for 2016-2018, otherwise it was 0. A dummy variable of an enterprise property right is called $Private_{it}$. Based on the classification of the ownership in Wind database, we give the value of private ownership enterprise 1, otherwise it is 0.

X_{it} is the control variables. Based on the existing research on corporate investment, vector X_{it} includes a group of lag control variables commonly used in previous studies, such as *size, Leverage*, *Cash* generate from operating activities, and *salesgrowth* rate [10]. According to previous experience estimates, for the property ownership right nature of the enterprise, we include a dummy variable $Private_{it}$. If a company belongs to a private enterprise in 2012-2019, takes 1, otherwise takes 0. When selecting industry variables, we use the 2016 version of the new industry code of CSRC classification. The code used here is the first level code. To account for unobservable time-invariant effects, a model with fixed effects is used in the empirical equation across many regression sections. To represent the impact of unobservable factors on industry-level investment decision-making, fixed or random effects are applied. In addition, to account for time-related investment determinants unique to each location, we additionally integrate an array of fixed impacts for different regions, such as GDP growth and inflation.

3.2 The variables

4 Empirical Results and Analysis

4.1 The baseline regression

Column (1) to (4) represent the regression results of the A-share sample firms showing a significant effect of *Environ_law* and Post_law on Invest_A and Invest_B. The results of the Capex. level of state-owned enterprises supports the study hypothesis 1. Compared with the coefficients of Environ_Law and Environ_ law * private, the F test (E1 + E2 = 0 test) shows that in the beginning stage of the implementation of the EPL significantly affects the investment.

4.2 Impact of EPL on the investment of labor-intensive and non-labor-intensive enterprises

Table 3 reports the test results of the listed companies in A-share firms according to the enterprise type. Columns (1), (2), (3), and (4) show the EPL's impact on corporate capital expenditures in labor-intensive enterprises; the impacts of the EPL on the investment of A-share listed companies and new third board enterprises are

Table 4: Impact of EPL on investments based on PSM Matching

	(1)	(2)	(3)	(4)
	Invest_A	Invest_B	Invest_A	Invest_B
Environ_Law	-0.4735***	-0.0121	-0.4361***	-0.0032
	(-10.9984)	(-0.2683)	(-11.5640)	(-0.0843)
Post_Law	-0.7784***	-0.0044	-0.6757***	0.0761**
	(-18.7649)	(-0.1010)	(-18.5249)	(2.0491)
Environ_Lawprivate	0.2495***	0.3200***	0.2586***	0.3516***
	(6.4472)	(7.9219)	(7.7029)	(10.2867)
Post_Lawprivate	0.1863***	0.4438***	0.1661***	0.4130***
	(5.5952)	(12.7707)	(5.7416)	(14.0223)
Size_W	1.0766***	1.1338***	1.0658***	1.1291***
	(96.3103)	(97.1721)	(109.1567)	(113.5578)
Leverage_W	-0.0090***	-0.0236***	-0.0092***	-0.0244***
	(-12.9925)	(-32.5436)	(-15.0695)	(-39.3279)
ROA_w	0.0191***	0.0172***	0.0167***	0.0176***
	(9.8786)	(8.5123)	(9.6818)	(10.0393)
Salegrowth_W	0.0000	0.0009***	0.0007***	0.0013***
	(0.1003)	(3.1433)	(3.0381)	(5.0192)
Bigholder	-0.0021***	-0.0025***	-0.0014**	-0.0014**
	(-2.6112)	(-2.9357)	(-2.0783)	(-2.0410)
Cashs_W	-1.0817***	-1.0865***	-0.8948***	-1.0029***
	(-9.5294)	(-9.1672)	(-8.8405)	(-9.7278)
_Cons	-3.2381***	-2.5646***	-3.2845***	-2.5763***
	(-35.6396)	(-27.0422)	(-41.3816)	(-31.8770)
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	10665	10663	15023	15021
Pseudo R2	0.5455	0.5381	0.5353	0.5130

different in the initial stage of implementation. The negative effect is significant for labor-intensive enterprises in A-share market.

The PSM-DID method is used to further eliminate endogeneity.

In this part, kernel density function curves were plotted after matching the proximity tendency scores between the treatment and control groups. Before the kernel matching, the distribution of the treatment group is relatively loose, while the control group tends to be left-biased and the distribution is relatively concentrated. The distribution of probability densities of the tendency scores for the two groups of samples is significantly different. If the differences between the two sample groups are not matched, serious estimation errors are bound to occur.

We use the nearest neighbor matching to match the control group and treatment group. In order to control the estimation error caused by sample selection, the PSM-DID method is further used. Specifically, the enterprise size (Size), financial leverage (Leverage), sales growth rate (Salegrowth), (Cash) operating cash flow, ROA, and large shareholder shareholding ratio (Bigholder) are taken as the characteristic variables, the samples from the therapy and control groups were matched using a matching method (radius of 0.05) and regressed on Invest_A and Invest_B according to model (2).

After PSM treatment, the probability density profiles of the two groups of samples are obviously identical, and the selectivity bias of the samples is basically eliminated. The sample balance test results show that the data characteristics of the two groups of samples are consistent and meet the requirement of comparability. In general, the two groups of samples have a more satisfactory matching effect. We have adopted the same method to deal with SOEs, and the result has not changed significantly.

5 CONCLUSION

The results show that: All the sampled enterprises' capex., and other long-term assets are severely impacted negatively by the implementation of EPL. In the early phases of its implementation, EPL does not have a substantial effect on investments in fixed assets and other long-term assets for private firms. While when EPLs are put into place, businesses drastically cut back on the money they spend on building and purchasing fixed assets, intangible assets, and other long-term assets, while they dramatically in capital expenditures.

EPL significantly reduces the sample firms' capital expenditures, both before and after it is implemented, regardless of whether they are labor-intensive or not, public or private, or both. For labor-intensive businesses, however, the effect of EPL implementation on corporate stock investments and other investment activities is negligible. On the other hand, this effect is continuously good

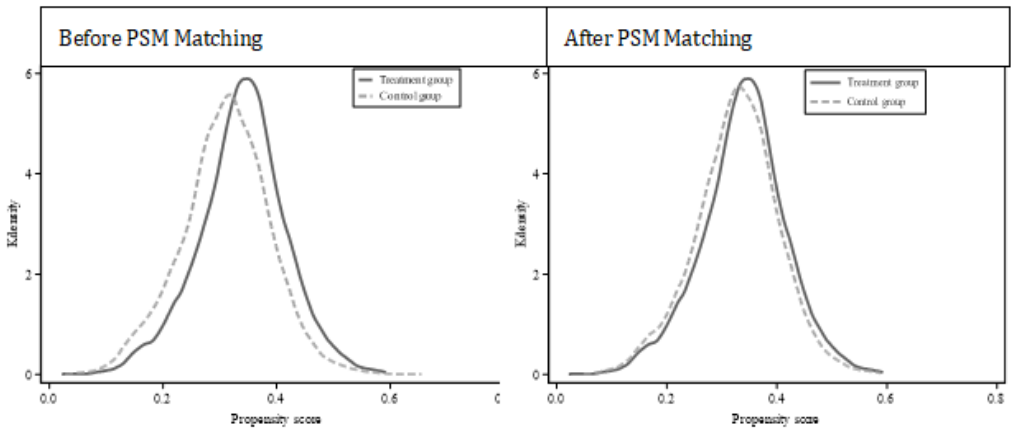

Figure 1: Comparison of Kernel density distribution of PSM before and after nearest neighbor propensity matching

for private businesses that do not require a lot of workers. Non-labor-intensive enterprises have significantly increased their equity investment and other investment expenditures, and their efforts have become even greater after the enforcement of EPLs.

The findings show that EPL increases the penalty of breaking rules and laws, which lowers business investment levels; Private companies are implementing remedies in reaction to the effects of EPL, such as increasing expenditures and decreasing dependency on human resources by upgrading antiquated buildings and equipment.

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