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Do Fiscal Environmental Protection Expenditures Crowd Out Corporate Environmental Protection Investments?

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Abstract: This research investigates how fiscal environmental expenditures impact corporate environmental investments and whether corporations act as free-riders. Using a sample of 1688 firm-year observations from 2008 to 2019 in the Chinese context, we observe that fiscal environmental expenditures have a significantly negative "crowding-out" effect on corporate green investments, which is mediated by the disclosure of pollution emissions. Additionally, a heterogeneity analysis reveals that this negative impact is more pronounced for non-heavily polluted and state-owned corporations and corporations located in three major agglomerations. This finding remains robust when employing an instrumental variable approach to address potential endogeneity. Our study contributes to the current literature by providing new insights regarding government environmental protection behaviors' impacts on corporate green behaviors. The study also provides insights for policymakers to focus more on light-polluting corporations and state-owned corporations, because they have more chances to avoid environmental responsibilities.

Keywords: environmental regulation; mediating effect; green investment; corporate environmental responsibility performance; environmental disclosure

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1. Introduction

China has experienced rapid growth in the past few decades. According to the National Bureau of Statistics (www.stats.gov.cn, accessed on 28 February 2022), China's GDP in 2021 was 1133 trillion yuan, ranking second globally. Meanwhile, with the government's increasing efforts to protect the environment, environmental quality has improved, but this process has not been smooth. In the 1980s, China adhered to a "pollution first" policy followed by treatment, including air pollution, water pollution, and other ecological problems that led to a deteriorated ecological environment. The nation's sulfur dioxide (SO_2) emissions rank first worldwide, 42% of its major water systems cannot be used as sources of drinking water, and only 46% of its solid waste is comprehensively utilized. Severe environmental problems caught the government's attention in the 20th century. As ecological improvement gradually became a core goal and main task, China's government has increased the amount of pollution treatment investments and fiscal environmental expenditures, with significant environmental treatment effects. As Figure 1 illustrates, environmental protection expenditures and pollution control investments have increased over the past decades, while pollution emissions have decreased.

Fiscal environmental expenditures increased, from 995.82 billion yuan in 2007 to 5.99 trillion yuan in 2020; of this, the proportion of public service expenditures increased from 11% to around 30%. China's environmental protection expenditures are divided into 14 categories, including the management of environmental affairs, basic preventions, pollution controls, and long-term prevention. Moreover, China's environmental quality improved, including its air and water quality. Sulfur dioxide and carbon dioxide (CO_2)

emissions decreased in 2006, and rapidly so in 2015. The nation had 3.18 million tons of SO_2 emissions in 2020—reflecting a decrease seven times since 1998—and the number of environmental pollution and damage incidents has decreased five times.

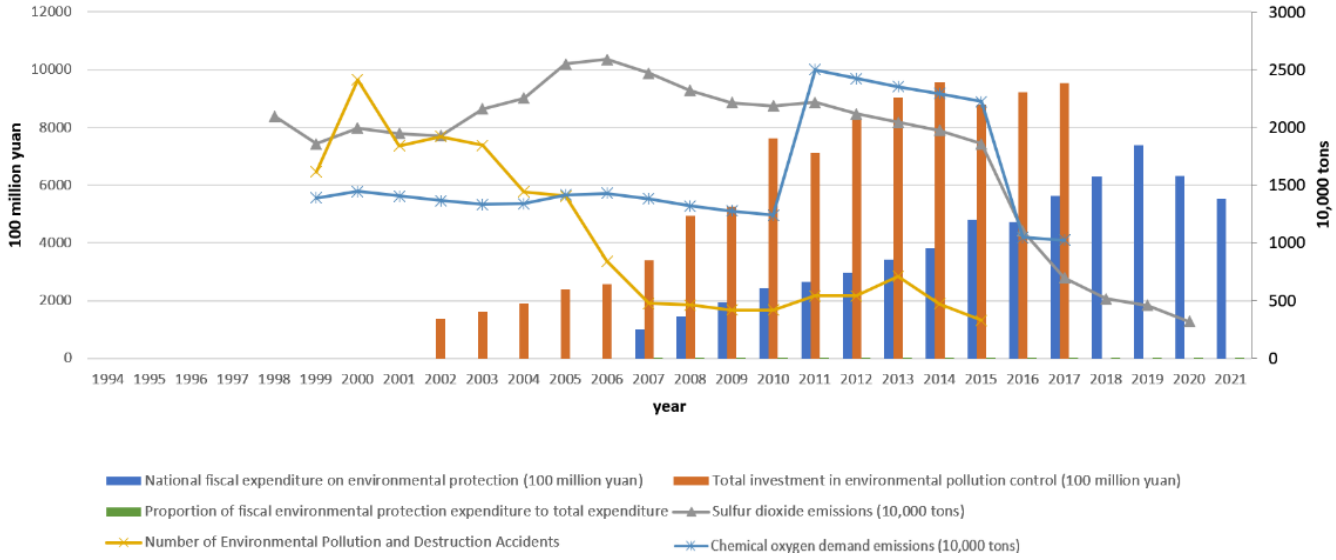

Figure 1. Environmental protection expenditures and environmental pollution in China. Data source: China National Bureau of Statistics (www.stats.gov.cn, accessed on 28 February 2022).

Although the ecological environment has improved due to the government's efforts, corporations are recognized as a primary factor in resource consumption and pollution and should also invest more in environmental protections. As Figure 2 indicates, industrial production accounts for approximately 80% of SO_2 emissions, 30% of wastewater emissions, and 20% of total water consumption. However, corporations can freely enjoy the environment if the government has addressed the nation's environmental problems. Without governmental support and strict regulations, environmental behavior may not be cost-effective, and corporations will be motivated to act as free-riders, or to reduce environmental investments if the fiscal environmental expenditures increase.

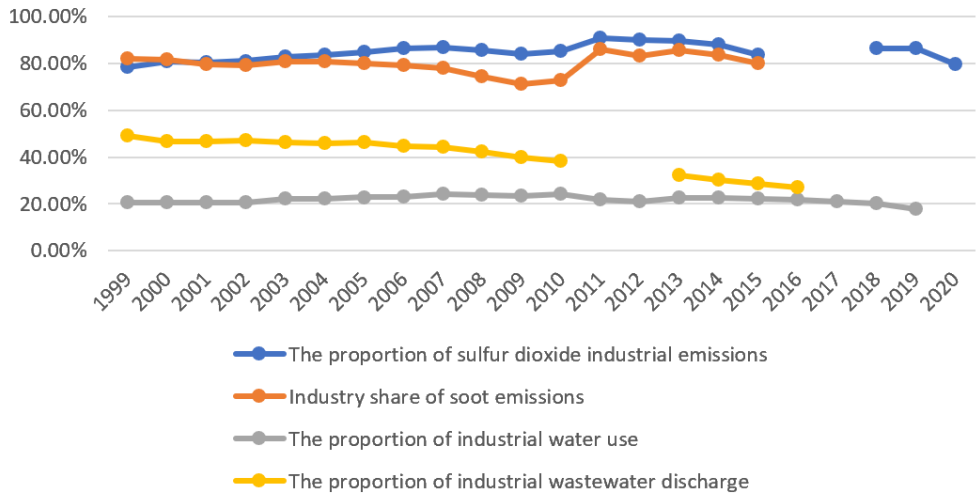

Figure 2. The proportion of industrial pollutant emissions. Data source: China National Bureau of Statistics (www.stats.gov.cn, accessed on 18 October 2021). Note: The data of the proportion of industrial water use in 2011 and 2012 and the proportion of sulfur dioxide industrial emissions in 2016 and 2017 are not acquirable.

Hence, this study investigates how fiscal environmental expenditures impact corporate environmental investments and determines whether corporations act as free-riders. Our sample consists of Chinese enterprises listed in A-share markets from 2008 to 2019. We use provincial fiscal expenditures for energy conservation and protection as the independent variable and collect enterprises' environmental investments reported in corporate social responsibility (CSR) reports as the dependent variable. We also control for other variables related to environmental investments, such as financial performance, institutional investors, and executive background. Additionally, we analyzed the mediation effects by separately adding the disclosure of pollutant emissions as a mediator to help determine the mechanism of the effect. Moreover, enterprises are classified according to whether they belong to heavily polluting industries, are state-owned, and are located in three major agglomerations. We use this classification in a heterogeneity analysis to discover what attributes can mediate the effect, and what enterprises are less likely to avoid their environmental responsibilities.

The results demonstrate that heavily polluting, private, and carbon-neutral corporations are less likely to be free-riders because of stricter environmental requirements or cost-effectiveness. An ordinary least-squares (OLS) regression with fixed effects for individuals and time reveals that fiscal environmental expenditures have a strong negative effect on enterprises' green investments. Specifically, enterprises avoid taking environmental responsibility because of cost ineffectiveness. Mediation analyses indicate that increasing environmental expenditures decreases corporations' willingness to disclose pollutant emissions and causes them to avoid environmental responsibilities, leading to a crowding-out effect on environmental investments. We introduced instrumental variables to address potential heterogeneity, and the results were consistent with the baseline results.

This study contributes to current literature in several ways. First, while most previous research focuses on the effects of regional social investments, we investigated environmental expenditures' microlevel effects on enterprises. Our study contributes to the current literature by providing new insights regarding government environmental protection behaviors' impacts on corporate green behaviors. Second, we extend previous studies on indirect environmental effects and further study the "green" behaviors of enterprises affected by fiscal environmental expenditures to discover the "free-riding" phenomenon among these corporations. Third, the study also provides insights for policymakers to focus more on light-polluting corporations, because they have more chances to avoid environmental responsibilities.

The remainder of this study is structured as follows: the next section presents a literature review and our hypotheses. Section 3 discusses the variables and data, while Section 4 presents the model and regression results. Section 5 provides conclusions and offers policy recommendations.

2. Literature Review and Hypotheses Development

2.1. Related Literature Regarding Fiscal Environmental Expenditures

Environmental expenditures are typically determined by the level of economic development and environmental pollution status. Cross-country studies demonstrate that spending should coordinate with national GDP and the environmental demand effect [1]. The "race to the bottom" strategic interaction also significantly affects the amount of fiscal environmental expenditures [2–6].

One way to measure these expenditures' environmental effects involves calculating spending efficiency, which can occur in two ways: the stochastic frontier analysis (SFA) and data envelopment analysis (DEA) [7], with positive impacts observed on eco-efficiency [8,9] and green productivity [6].

Existing literature also examines public environmental spending's environmental and economic effects. In particular, green spending and effective environmental regulations have improved environmental quality [10,11]. In China, some researchers have noted that the environmental Kuznets curve can be an inverted N-shape [12] or inverted U-shape [13]. Fiscal environmental expenditures also indirectly and positively affect environmental

quality [14], although less so than through the direct effect [11]. Regarding economic effects, more jobs are created [15,16] and economic upgrading is accelerated [1,12,17,18]. Further, the industrial structure becomes optimized [19] and productivity improves [13,20]. As for technological innovation, research favors a "weak" Porter hypothesis [21]. However, stricter environmental regulations are harmful to industrial exports [22], and environmental policies negatively impact GDP [23,24]. Moreover, there is no significant effect on firm productivity because pollution reduction is ineffective for firms [25].

Most studies have examined the impact on enterprises in terms of innovation. Environmental regulations include command-controlled, market-incentive, and voluntary environmental regulations [26]. These regulations enhance enterprises' technological innovation of enterprises [27,28], and the result holds for both voluntary [29] and regional environmental regulations, with a U-shaped relationship between environmental regulations and innovation [30]. The total impact is determined by the combined "offset" and "compensation" effects; innovation capacity decreases in the short term, but will improve in the long term, with the predominance effect changing from an offset to a compensation effect [31]. Stronger environmental regulations encourage green innovation [32,33], and especially for heavily polluting companies [34]. Research has found a negative effect on innovation investment [35].

Sufficient literature has examined the environmental effects of fiscal environmental spending. Regarding economic effects, most studies focus on the effects on the regional economy, industry productivity, and corporate innovation. Only a few studies discuss the relationship between fiscal environmental expenses and corporate environmental protection investments.

2.2. Literature on the Factors Affecting Environmental Investments

Corporate financial performance, such as firm size [36] and profitability [37], is a type of corporate investment, although financial resources only have positive impacts on green investments for a short time [38]. As for shareholders, institutional investors tend to undervalue stocks with negative environmental indicators [39,40], and their participation improves environmental responsibilities [39,41,42].

Literature also addresses executive characteristics' impacts, as corporate social performance positively relates to having CEOs with higher educational degrees [43,44] and an economics major [45]. Gender diversity improves corporate environmental responsibility (CER) [45–49], and female directors' talent, experience, and age [44,50] also have a positive influence. However, a negative relationship exists between CER performance and CEO tenure [51]. Organizational resources—including high managerial competency [52,53], managerial satisfaction [54], and rational governance [55], or the existence of a sustainability committee [44,56]—positively affect corporate environmental practices. In terms of firm strategy, having proactive environmental strategies [36,57,58], a philanthropic strategy [59], or green supply chain management [60] encourage green behaviors.

Different forms of environmental regulations influence corporate green investments [61,62], including green debt [63], mixed environmental protection policies [64,65], and regulatory climate [66,67]. A positive relationship also exists between public appeal and environmental investments [68]. Further, market competition tends to decrease CER behaviors [53,69], and the national climate risk subsequently decreases environmental investments [70].

2.3. Fiscal Environmental Expenditures and Enterprises' Environmental Investments

Existing literature on fiscal environmental expenditures' impacts on enterprises' environmental investments is divided into two groups: those observing a negative impact on corporate investments [28,35] and corporate environmental responsibility [71]. Although governments provide subsidies and green financing tools to support firms' green behavior, firms bear most of the costs [72]. In the short term, the low economic benefits [73] cannot offset the high cost of environmental production [74]. Investing too many funds without profit harms other investments and financial performance [75]. As implementing expendi-

tures to benefit the environment constitutes a type of fiscal responsibility [71], they also refer to governments' actions to improve the overall environment. Improved quality forces enterprises to face higher environmental standards, and thus, require more funds invested. Without strict enforcement and supervision, corporations strongly avoid investing in green behavior while still freely enjoying the improved environment. As environmental quality can be considered a public good, and firms can be considered users of public goods, these firms lacking sufficient environmental investments can exhibit "free-rider" behavior. In capital markets, such behavior can be corrected to some extent as the market is concerned about environmental protection. Green assets such as green bonds and green equity are priced higher than nonecological-friendly assets.

Given this information, we anticipate that fiscal environmental expenses have a "crowding-out" effect on corporate environmental investments because of their low cost-benefit efficiency. Thus, we present the following Hypothesis 1a:

Hypothesis 1a (H1a). *Fiscal environmental expenses "crowd out" enterprises' environmental investments, and consequently, enterprises tend to be free-riders and avoid environmental responsibility.*

However, literature has determined that this relationship is U-shaped [31,75]. In the short term, environmental regulations decrease firms' green investments because of increased environmental management costs and decreased financial performance [38,76]. In the long term, this effect becomes positive after a specific threshold, because corporations are forced to improve their environmental efficiency [77] to reduce costs [31]. This is in accordance with Porter's hypothesis, and the opposite conclusion is reasonable.

Several studies have proven this promotional effect. More than just green investments, corporate environmental performance is considered to be of interest to local governments [78]; therefore, corporate green behavior must be consistent with government regulations. As firms are affected by the government, they have an incentive to perform in a particular way for financial benefits [79,80]. Increasing environmental investments results in enhanced profit margins [53,81], lower capital costs [82], and improved innovation [26,83] and stock market performance [84].

Public environmental expenditures lead to enhanced financial quality and market competitiveness through increased green corporate investments. Firms are more willing to invest environmentally when facing increased public environmental expenditures, and we expect that a "promotional" effect exists, as posited in the following Hypothesis 1b:

Hypothesis 1b (H1b). *Fiscal environmental expenses have a "promotional" effect on enterprises' environmental investments.*

We further confirm Hypothesis 1 by identifying the factor that acts as a mediating variable. A significant relationship exists between governments' environmental strategies and corporations' environmental behaviors [57,85]. With the increase in public environmental expenditures and improved ecological quality, environmental behaviors may change—and corporations' disclosure of pollution emissions in particular. Such disclosures refer to how a company describes pollutant emissions in its social responsibility report, including wastewater, carbon, SO_2, CO_2, soot dust, and solid waste. Corporations may describe these emissions qualitatively, quantitatively, or not at all. Governments' environmental treatment impacts corporations' green behavior, which manifests as pollutant emissions disclosures.

Corporate environmental behaviors directly affect green investments and environmental responsibility [56,77,86]. This is because corporations' behaviors and attitudes are predictors of environmental proactivity, which positively influences environmental investments [87]. As environmental disclosures are a type of environmental behavior, they significantly affect firms' green investments [29,34]. Pollutant emissions are one of the most important factors in green investments, and thus, we anticipate that a relationship exists between enterprises' pollutant emissions disclosures and their green investments. We also expect that public environmental spending's impact on corporate green investments is

mediated by the disclosure of pollutant emissions in corporate social responsibility reports, as demonstrated by the following Hypothesis 2:

Hypothesis 2 (H2). *The mediating variable between public environmental spending and corporate green investment is the disclosure of pollutant emissions in corporate social responsibility reports.*

Next, we explore what type of corporation invests more in environmental protections and is less likely to avoid environmental responsibility. As enterprises' primary businesses differ, and the environmental impacts from their production processes vary, they may need to satisfy different environmental requirements.

First, heavily polluting industries face stricter regulations and require regular environmental reports [88]. They invest significantly more in environment protection [78]. Thus, heavily polluting firms are more likely to have green investments than those in non-heavily polluting industries, leading to the following Hypothesis 3a:

Hypothesis 3a (H3a). *Non-heavily polluting corporations are more likely to avoid environmental responsibility, and heavily polluting corporations invest more in environmental protections.*

Second, state-owned corporations always invest more than private corporations. The government and state-owned enterprises (SOEs) have a closer relationship, and the latter respond more actively to government policies [19,78]. Additionally, the government favors SOEs both financially and legally, and SOEs have better access to financing as a result; this makes it easier for them to conduct green investment practices and adopt environmental technologies [89]. Thus, SOEs invest more in environmental protections than private companies, leading to our Hypothesis 3b:

Hypothesis 3b (H3b). *State-owned enterprises respond more actively to public environmental expenditures and spend more on green investments than private corporations.*

Geography is also an important factor that influences enterprises' green investments, as different locations have different environmental restrictions [19,70] and imbalanced economic development [8], leading to differences in enterprises' environmental protection awareness [90]. Also, there is a strategic interaction among regions with environmental regulations. The mode of strategic interaction is "race to the bottom" or "race to the top". The former means one region will strengthen environmental regulation if the adjacent region has done this [5]. The latter means one region will reduce environmental expenditure if the competitive area has reduced first [6].

Due to its location and economic development level, China is generally divided into three districts: eastern, central, and western. The three regions' environmental quality and regulations differ, and the economic development gap between the eastern and western districts is particularly broad. The total GDP of the western and central regions accounts for only about two-thirds of that of the eastern region. Environmental efficiency in the western region is far worse than that in eastern China [91], and environmental regulations have an opposite effect on corporations in the eastern area compared to that in China's western and central areas [27]. Moreover, environmental spending has significantly different impacts on enterprises' green investments in different regions. Specifically, this impact is positive and significant in the eastern area due to its rapid development and stricter regulations; in contrast, this impact is negative in the eastern and western regions.

Additionally, most listed companies in China are located in the eastern region, and especially those in China's three major urban agglomerations: the Yangtze River Delta, Pearl River Delta, and Beijing–Tianjin–Hebei Urban Agglomeration. The environmental quality and governmental regulations differ in the three urban agglomerations. Hence, we examined the three urban agglomerations and expected that their impacts might vary, as posited in the following Hypothesis 3c:

Hypothesis 3c (H3c). *Environmental spending has significantly different impacts on enterprises' green investments in different regions and among China's three urban agglomerations.*

3. Data and Variable Definitions

3.1. Data

Our sample consisted of Chinese A-share-listed companies, with data spanning January 2008 to December 2019. At the corporate level, the environmental protection investment data were derived from CSR or CER reports, and other data from the WIND database. At the regional level, the government's financial environmental protection expenditures from each province are included in each year's *China Statistical Yearbook*.

We collected data from 2008 for two reasons: First, at the government level, the "environmental protections" expenditure category was first established in 2007. Second, companies began to disclose their environmental information at this time. In 2006, the Shenzhen Stock Exchange issued the "guidelines on social responsibility of listed companies" (www.szse.cn, accessed on 25 June 2006); the Shanghai Stock Exchange issued a similar guideline in 2008. In these guidelines, the two stock exchanges encourage corporations to publish corporate social responsibility reports and disclose their performance related to their social and environmental responsibilities. Subsequently, corporations began to distribute CSR or CER reports that listed environmental investment data.

The data-collection process included the following criteria to improve the research's accuracy: samples with missing data were excluded from the analysis, and the sample companies included those that were neither suspended nor delisted.

3.2. Variables

3.2.1. Corporate Green Investments *(FirmEnv(ln))*

Prior research measures corporate green investment in two ways. First, it has considered the amount of environmental protection investments disclosed in the CSR report, and second, it has provided a score for the report's disclosure content. We obtain more accurate results by using the first method and collecting data on the amounts of green investments that corporations have disclosed in their CSR or CER reports. Enterprises may mention some of the following green programs in their reports: environmental protection investments; environmental protection equipment; pollution, waste gas, or sewage treatments; energy-saving and emissions-reducing methods; energy-saving technical transformations; traditional technical transformations; and recycling, desulfurization, and dust removal processes. We aggregate the investments in such green projects and take the logarithm of this variable to reduce the absolute value of the data. Thus, we obtain our dependent variable *(FirmEnv(ln))*. Taking the logarithm does not change the nature and correlation of the data and can compress the scale of the variable. This variable represents the percentage change in corporate environmental protection investment.

3.2.2. Fiscal Environmental Protection Expenditures *(GovEnv(ln))*

The independent variable was fiscal environmental protection expenditures, as the "environmental protection expenditures" item is a part of total fiscal expenditures within the government's provincial-level budget. In 2011, this category was renamed "energy conservation and environmental protection expenditures." We collect data from the *Provincial Statistical Yearbook* (2008 to 2019), with its logarithm as the independent variable. This variable represents the percentage change in fiscal environmental protection expenditures. As the dependent variable is also in logarithmic form, both variables have economic implications and meet the definition of elasticity. We can measure the sensitivity of corporate green investments through the fiscal environmental protection expenditures.

3.2.3. Control Variables

As corporations' financial performance may affect their green investments, we add the logarithm of a firm's total assets (*Asset(ln)*), return on assets (*ROA*), asset–liability ratio (*AssetLiabRatio*), fixed-assets ratio (*FixAssetRatio*), receivables–turnover ratio (*RTRatio*), and leverage ratio (*LevRatio*) in the regression to control for these variables' effects. In terms of management characteristics, we add board size (*BoardSize*) and the management team's average age (*MngAvgAge*) in the regression. Finally, we add provincial variables to control for regional-level influences, including the share of the secondary industry in GDP (*SndIndGDPRatio*), provincial GDP per capita (*AvgGDP*), carbon emissions (CO_2*Emission*), and environmental taxes (*GovEnvTax*). Table 1, Panel A presents the definitions of these variables.

Table 1. Summary statistics of main variables.

Panel A: Variable Definition

FirmEnv(ln)	Logarithm of green investment amount that firms disclosed in CSR or CER reports
GovEnv(ln)	Logarithm of provincial fiscal energy conservation and environmental protection expenditures (in units of 10,000 yuan)
SndIndGDP	The percentage share of secondary industry to GDP
AvgGDP	The provincial GDP per capita (in units of 10,000 yuan)
CO_2*Emission*	The sum of CO_2 emissions from various energy sources by province (in units of 10,000 tons)
GovEnvTax	Sum of resource, urban maintenance and construction, urban land utilization, vehicle and vessel, and farmland occupation taxes (in units of 10,000 yuan)
Asset(ln)	Logarithm of total assets of listed firms (in units of 1000 yuan)
ROA	Net income/total assets
LevRatio	(Net profit + income tax expense + financial expense)/(net profit + income tax expense)
AssetLiabRatio	Total liabilities/total assets
FixAssetRatio	Fixed assets/total assets
RTRatio	Operating income/ending accounts receivable balance
BoardSize	Number of board members
MngAvgAge	Average age of management team
DscPollEMIS	The disclosure of pollutant emissions, including the disclosure of wastewater, COD, SO_2, CO_2, soot dust, and solid waste.

Panel B: Descriptive Definition

Variables	Mean	Std. Dev	25%	50%	75%	Min.	Max.
FirmEnv	28,300,000.00	359,000,000.00	359.38	2399.16	16,635.64	0.00	7,760,000,000.00
GovEnv	1,966,325.00	1,270,236.00	998,405.00	1,693,100.00	2,670,062.00	109,789.00	7,474,388.00
SndIndGDP	42.3298	9.3126	39.2999	44.3247	48.5400	15.8000	61.5000
AvgGDP	6.9371	3.2284	4.4347	6.3472	9.0993	0.8824	16.4890
CO_2*Emission*	50,289.20	32,092.60	26,471.33	44,952.70	69,203.56	4133.09	151,698.30
GovEnvTax	4,212,742.00	2,513,889.00	2,293,842.00	3,426,300.00	6,116,736.00	28,740.00	10,200,000.00
Asset	12,900,000.00	117,000,000.00	234,923.90	539,466.90	1,521,899.00	1311.54	2,460,000,000.00
ROA	0.0618	0.1041	0.0316	0.0569	0.0923	−1.1702	4.9128
LevRatio	3.2619	7.5856	1.3157	1.6906	2.5882	−1.1968	237.8904
AssetLiabRatio	0.4960	0.2351	0.3384	0.4975	0.6392	0.0071	4.9952
FixAssetRatio	0.2808	0.1782	0.1373	0.2559	0.4021	0.0000	0.9204
RTRatio	1755.0380	120,882.0000	3.8765	7.7028	20.4588	0.0709	9,546,353.0000
BoardSize	9.1591	2.1145	8.0000	9.0000	9.0000	3.0000	21.0000
MngAvgAge	50.0417	3.0626	48.0000	50.0700	52.1000	35.6200	61.8600
DscPollEMIS	2.5693	2.7685	0.00	2.00	4.00	0.00	12.00

Panel C: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) GovEnv(ln)	1													
(2) SndIndGDP	−0.257	1												
(3) AvgGDP	0.479	−0.588	1											
(4) GovEnvTax	0.704	0.112	0.341	1										
(5) CarbnEmission	0.378	0.393	−0.045	0.758	1									
(6) Asset(ln)	0.028	−0.262	0.11	−0.085	−0.086	1								
(7) ROA	−0.002	0.103	−0.022	0.047	0.069	−0.1	1							
(8) FixAssetRatio	−0.154	0.134	−0.205	−0.078	0.072	0.016	−0.014	1						
(9) RTRatio	−0.021	0.014	−0.006	−0.014	−0.012	0.003	−0.006	0.02	1					
(10) BoardSize	−0.145	0.007	−0.129	−0.153	−0.049	0.39	−0.036	0.05	−0.013	1				
(11) MngAvgAge	0.077	−0.228	0.173	−0.015	−0.049	0.466	−0.08	0.061	0.006	0.207	1			
(12) LevRatio	−0.05	0.029	−0.063	−0.047	−0.007	0.034	−0.169	0.17	0.024	0.035	0.033	1		
(13) AssetLiabRatio	−0.1	−0.042	−0.093	−0.143	−0.098	0.457	−0.273	0.056	0.015	0.24	0.149	0.174	1	
(14) DscPollEMIS	0.022	−0.0477	0.0044	0.0007	0.036	0.2709	0.0435	0.1648	0.0299	0.1137	0.2168	0.0334	0.0298	1

3.2.4. Mediator *(DscPollEMIS)*

The mediator is the disclosure of pollutant emissions. This mediator is collected from CSR and CER reports in which corporations have disclosed their pollutant emissions, including wastewater, COD, SO_2, CO_2, soot dust, and solid waste. Firms may describe these emissions qualitatively or quantitatively, or not at all. If the corporation quantitively

discusses a specific pollution emissions item, we assign this item a score of two; if the corporation refers to the emissions qualitatively, we assign it a score of one; and if the corporation does not mention certain emissions, then the score is zero. We add the scores for wastewater, COD, SO_2, CO_2, soot dust, and solid waste as mediators.

3.3. Descriptive Statistics and Correlation Matrix

Table 1, Panel B provides the descriptive statistics, and panel C presents the correlation matrix of variables. Correlations between most variables are low. Regarding the dependent and independent variables, the mean of corporate green investments was 28.3 million yuan. The mean fiscal environmental expenditures included 19.7 billion yuan, with a relatively small gap in government environmental protection expenditures. The gap between the maximum and minimum values of corporate green investments is larger, and the maximum value is much larger than the 75% quantile, or only 16,636 yuan. Therefore, the mean value increased by the remaining 25%.

In terms of corporate-level control variables, the mean of total corporate assets is 12.9 billion yuan, while the means of the ROA, leverage ratio, asset–liability ratio, fixed-assets ratio, and receivables–turnover ratio are 0.0618, 3.2619, 0.4960, 0.2808, and 1755.0380, respectively. The ROA has the smallest standard error, and that of the receivables–turnover ratio is much larger than that of the remaining four variables. The average board size was 9.1591, and the management team's average age was 50 years. Regarding the provincial control variables, the average share of secondary industry to total GDP is 42.33%, and the maximum share is 61%. The average GDP per capita is 69,371 yuan. The average total CO_2 emissions were 502.892 million tons, and the government's environmental tax was 4.2127 billion yuan.

4. Empirical Results and Discussion

4.1. Baseline Results

We calculate the government environmental expenditures' effect on corporate green investments by estimating the OLS regression model, as follows:

$$FirmEnv(ln) = \beta 0 + \beta 1 \times GovEnv(ln) + \beta 2 \times SndIndGDP + \beta 3 \times AvgGDP + \beta 4 \times GovEnvTax + \beta 5 \times CO_2Emission + \beta 6 \times Asset(ln) + \beta 7 \times ROA + \beta 8 \times AssetLiabRatio + \beta 9 \times FixAssetRatio + \beta 10 \times RTRatio + \beta 11 \times BoardSize + \beta 12 \times MngAvgAge$$

where *FirmEnv(ln)* as the dependent variable represents the logarithm of corporate green investments; the *GovEnv(ln)* independent variable is the logarithm of the government's environmental expenses. The corporate control variables include *Asset(ln)*, the return on assets (*ROA*), asset–liability ratio (*AssetLiabRatio*), fixed-assets ratio (*FixAssetRatio*), receivables–turnover ratio (*RTRatio*), and leverage ratio (*LevRatio*). In terms of management characteristics, we add the board's size (*BoardSize*) and management team's average age (*MngAvgAge*) in the regression. Provincial control variables included the share of secondary industry to GDP (*SndIndGDPRatio*), provincial GDP per capita (*AvgGDP*), carbon emissions ($CO_2Emission$), and environmental taxes (*GovEnvTax*).

Specifications 1 and 2 in Table 2 contain an analysis of the government environmental expenses' influence on corporate green behavior. The dependent variable is the percentage of change in corporate environmental protection investments. The independent variable is the percentage of change in government expenditures on environmental protections. The control variables include assets, return on assets, the asset–liability ratio, fixed-assets ratio, receivables–turnover ratio, leverage ratio, board size, management team's average age, share of secondary industry in GDP, provincial GDP per capita, carbon emissions, and environmental tax. Specification 2 in Table 2 omits three insignificant variables from the regression, and the R-squared value increases. We control for individual and time effects and assume that a linear relationship exists among the variables.

Table 2. Baseline results.

	(1)	(2)	(3)
	Baseline	**Baseline**	**Instrumental Variable**
GovEnv(ln)	−1.1204 **	−0.9567 **	−4.0293 **
	(−2.1369)	(−2.1679)	(−2.5576)
SndIndGDP	0.1135 *	0.1004 *	−0.0839 **
	(1.7525)	(1.7093)	(−2.2627)
AvgGDP	−0.0387		−0.0800
	(−0.1759)		(−1.3759)
GovEnvTax	−0.0000	−0.0000	0.0000 **
	(−1.1807)	(−1.2208)	(2.3568)
$CO_2Emission$	0.0001 **	0.0001 *	−0.0000 **
	(2.0581)	(1.9229)	(−2.0369)
Asset(ln)	0.7504 ***	0.6566 ***	1.0898 ***
	(3.0046)	(2.8268)	(10.6255)
ROA	8.3961 ***	7.3355 ***	3.7444 **
	(4.2015)	(4.7258)	(2.1942)
FixAssetRatio	2.5960 **	2.3242 **	1.8257 ***
	(2.2186)	(2.1334)	(2.9634)
RTRatio	0.0000 ***	0.0000 ***	−0.0000
	(7.3754)	(6.4749)	(−1.3830)
BoardSize	0.1343	0.1288 *	0.1450 ***
	(1.5510)	(1.6618)	(3.1034)
MngAvgAge	0.2311 ***	0.2124 ***	−0.0042
	(2.9435)	(2.8182)	(−0.0925)
LevRatio	0.0065		0.0244 ***
	(0.7527)		(2.9413)
AssetLiabRatio	−0.4872		0.3636
	(−0.4292)		(0.5346)
_cons	−7.7616	−7.1372	48.2721 **
	(−0.8925)	(−1.0169)	(2.1101)
Firm FE	Yes	Yes	Yes
N	1541	1688	1379
R-squared	0.0999	0.1077	0.1116

Notes: This table reports the main regression results. Our key independent variable is *GovEnv(ln)*. Columns 1 and 2 in Table 2 contain an analysis of the government environmental expense's impact on corporate green behavior. Column 2 omits the last three variables from the regression. Column 3 displays the instrumental variable (IV) results. The *t*-statistics as noted in parentheses are corrected for heteroscedasticity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Our analysis focuses on the independent variable's coefficients to determine whether fiscal environmental expenditures have positive or negative impacts on firms. The results in Specification 1 demonstrate that the government's environmental expense negatively impacts corporate green investments; specifically, every 1% increase in government environmental spending led to a 1.12% decrease in corporate green investments. The decrease was highly significant, with a *p*-value of 0.05. After removing four of the control variables, as in Specification 2, the negative impact decreased to 0.9567, and the R-squared value increased.

The results are consistent with Hypothesis 1a, which posits that government environmental spending negatively influences firms' green investments. Therefore, corporations avoid environmental responsibility with an increase in fiscal environmental input. While government efforts may restore and promote the ecological environment, the government's behavior has failed to encourage enterprises to invest in environmentally friendly businesses. The "crowding-out" effect exists for complicated reasons. First, corporations' green behaviors require substantial funds and result in little profit. Such behaviors include updating environmentally friendly devices, investing in green technologies, and reducing pollutant emissions. These behaviors do not generate significant profits within a short time. Moreover, investors of listed enterprises focus more on financial performance; without strict regulations or clearly defined environmental responsibilities, corporations are not

motivated to implement such cost-inefficient programs. However, market participants and the government may focus more on clean production in certain industries, and these companies are not expected to behave as free-riders and must provide more green investments. We will discuss this further in Section 4.3, heterogeneity analysis.

Second, the environment can be perceived as a public good, and protective behaviors have a spillover effect. Further, regional interactions occur in terms of provincial environmental protection investments [5], as regional governments will increase their spending if the neighboring district does so. This interaction reflects the "rise to the top" phenomenon [4]. Influenced by such interactions, corporations enjoy the benefits of an improved environment and are reluctant to spend extra money or effort to help protect the environment.

Third, environmental responsibility is difficult to clearly define. If each corporation's environmental responsibility is clearly defined, the public good's external effects will be internalized. With detailed requirements on environmental performance, corporations must take responsibility for and invest in it.

Our "crowding-out" effect partially confirmed Ouyang's findings [31]. According to Ouyang (2020), environmental regulation reduces firms' green investments in the short term but improves it in the long run. In our results, fiscal environmental expense negatively impacts both the short term and long run. The reason is that Ouyang (2020) uses standardization of pollutant discharge to represent environmental regulation. Compared with governments' environmental spending in our research, the indicator has a stronger regulatory effect on enterprises. Thus, with weaker enforcement of environmental protection, increasing government environmental spending reduces firms' green investments.

Regarding the control variables, firms with higher financial quality are more capable of increasing green investments. The increase in total assets, *ROA*, fixed-assets ratio, and receivables–turnover ratio facilitates enterprises' investments in environmental protections. The coefficient of *ROA* is 8.40 and is the largest coefficient among the financial indicators; this measures a company's efficiency using its assets to generate profit. A company with a larger *ROA* invests more money in environmental protections. The total assets increased by 1%, resulting in a 0.75% increase in corporate green investments. A higher fixed-assets ratio indicates that corporations rely more on fixed production facilities. They are influenced by low-carbon trends, and are more motivated to facilitate a green transformation to increase competitiveness. The coefficient of the fixed-assets ratio is 2.596; a higher receivables–turnover ratio also significantly and positively impacts green investments, although the coefficient is smaller.

Regarding management characteristics, a larger board size and older management team also help stimulate such investments, as they more thoroughly discuss relevant issues, reduce operating risks, and improve accuracy when making decisions. The coefficients of the leverage and asset–liability ratios are not significant.

Among our provincial indicators, the share of secondary industry to GDP and carbon emissions has positive environmental impacts. As the secondary industry's production activities always lead to resource consumption and environmental damage, it is reasonable for enterprises to increase their environmental protection investments. For example, carbon emissions are an important type of greenhouse gas, and increasing these will increase ecological treatment behaviors. In contrast, the coefficients of the average GDP per capita and environmental taxes were not significant.

We then compare the four provincial variables; the first two variables—which quantitatively and directly or indirectly represent changes in regional environmental quality—significantly and positively impact enterprises' environmental protection input. The government always conducts environmental regulations based on such indicators, with proposed detailed environmental protection requirements for industries' production and emissions. Subject to such regulations, enterprises must increase their green investments to meet ecological requirements.

The provincial control variables' positive impact also explains why the relationship between fiscal environmental spending and enterprises' green investments is positive. In contrast to the previously noted indicators, which lead to policy enforcement and supervision, fiscal environmental protection spending primarily aims to improve the ecological environment. Enterprises may voluntarily increase their green investments, as encouraged by the government. However, without strict regulations, most firms faced with increased governmental contributions and an improved environment decrease such investments in consideration of low cost-benefit efficiency.

We address potential endogeneity by using an IV approach. Our findings suggest that corporations reduce green investments if government environmental expenditures increase. It may be argued that when corporations reduce green investments, causing a deterioration of environmental quality, the government must increase its environmental protection input. Therefore, the direction of causality may run from fiscal environmental investments to enterprises' green investments, or vice versa. We used an IV approach to address this endogeneity issue related to reverse causality. Specifically, we used the wastewater chemical oxygen demand (COD) as an instrumental variable, as this indicator represents the degree of organic pollution in each province's wastewater. Provincial environmental indicators can affect the amount of fiscal environmental spending. Further, corporations care more about specific production-related pollution requirements rather than regional environmental quality. Therefore, corporate environmental protection investments are insensitive to this instrumental variable. Table 2, Column 3 presents the results. We observed that fiscal environmental expenditures reduce corporate green investments, a result that is statistically significant and consistent with our main results.

4.2. Mediating Effect Analysis

The previous section's results revealed that fiscal environmental expenditures negatively influence corporate green investments. These results are consistent with the crowding-out hypothesis. In this section, we determine the mechanism of this effect, and used a mediator in our mechanism analysis. We first examined what mediator is affected by the increase in fiscal environmental expenditures, and the change in this mediator leads to a change in corporate green investments. Our regression introduced this mediator: the disclosure of pollutant emissions.

The results prove our hypothesis, in that firms' pollution emissions-related behavior mediates this effect. Increasing fiscal environmental expenditures also increases corporations' willingness to increase emissions and engage in fewer green behaviors.

We introduce the mediator: the disclosure of pollutant emissions. This mediator is collected from corporate social responsibility reports in which corporations have disclosed their pollutant emissions, including wastewater, COD, SO_2, CO_2, soot dust, and solid waste. As not all the items need to be mentioned in one report, and these items are not required to be disclosed in a specific form, the results depend on the corporation itself. Firms may describe these emissions qualitatively or quantitatively, or not at all. If a corporation reveals items that are more comprehensive and specific in their social responsibility report, this indicates their increased willingness to control pollution and take environmental responsibility. Whether and how they disclose pollution emissions reflects their willingness to protect the environment.

What is governmental environmental expenses' impact on companies' willingness to protect the environment? Moreover, how does the mediator act on corporate green investments? Table 3 illustrates the results; Column 1 displays the total effects. It depicts the regression results of corporate green investments regressed against fiscal environmental expenses. The mediating variable was excluded from the regression analysis. As previously mentioned, the total effect—including direct and indirect effects—is −1.12 and significant.

Table 3. Mediating effect analysis.

	(1)	(2)	(3)	(4)
	FirmEnv(ln)	***DscPollEMIS***	***FirmEnv(ln)***	***FirmEnv(ln)***
GovEnv(ln)	−1.1204 **	−0.3143 *		−1.0215 *
	(−2.1369)	(−1.6644)		(−1.9112)
SndIndGDP	0.1135 *	0.0037	0.1169 *	0.1157 *
	(1.7525)	(0.1682)	(1.8072)	(1.7984)
AvgGDP	−0.0387	−0.0638	−0.3366 *	−0.0612
	(−0.1759)	(−0.8759)	(−1.6772)	(−0.2758)
GovEnvTax	−0.0000	−0.0000	−0.0000	−0.0000
	(−1.1807)	(−0.4680)	(−0.6524)	(−1.2302)
$CO_2Emission$	0.0001 **	−0.0000	0.0001 **	0.0001 **
	(2.0581)	(−0.9760)	(2.2737)	(2.1186)
Asset(ln)	0.7504 ***	0.0118	0.0000 **	0.7507 ***
	(3.0046)	(0.1164)	(2.1936)	(2.9109)
ROA	8.3961 ***	−0.2815	7.3088 ***	8.1443 ***
	(4.2015)	(−0.3976)	(3.2135)	(3.9735)
FixAssetRatio	2.5960 **	−0.2662	3.1284 **	2.7731 **
	(2.2186)	(−0.5577)	(2.376)	(2.3202)
RTRatio	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(7.3754)	(4.7629)	(6.5366)	(6.8999)
BoardSize	0.1343	−0.0009	0.1476	0.1286
	(1.5510)	(−0.0169)	(1.6207)	(1.4709)
MngAvgAge	0.2311 ***	−0.0261	0.2489 ***	0.2361 ***
	(2.9435)	(−0.9334)	(3.1303)	(3.0006)
LevRatio	0.0065	−0.0085 ***	0.0065	0.0069
	(0.7527)	(−3.0229)	(0.8499)	(0.8084)
AssetLiabRatio	−0.4872	−0.5720	−0.387	−0.5740
	(−0.4292)	(−1.3980)	(−0.3253)	(−0.4940)
DscPollEMIS			0.1144 **	0.1043 **
			−2.4921	(2.2505)
_cons	−7.7616	7.4995 **	−13.1279 **	−9.5810
	(−0.8925)	(2.2502)	(−2.4803)	(−1.0837)
Firm FE	Yes	Yes	Yes	Yes
N	1541	1535	1535	1535
R-squared	0.0999	0.1360	0.0947	0.1040

Notes: Column 1 in Table 3 illustrates the total effect. The mediator—the environmental pollution disclosure—is regressed on fiscal environmental expenses, and Column 2 displays the results. We regress both the main independent variable and mediator on the dependent variable, and the results are shown in Column 3 of Table 3. The *t*-statistics as noted in parentheses are corrected for heteroscedasticity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

We then conducted a mediation analysis by regressing the mediator against fiscal environmental expenses. Column 2 in Table 3 presents the results. The coefficient of fiscal environmental expenses is −0.3143. Moreover, the increase in fiscal environmental expenses decreases corporations' willingness to protect the environment; therefore, these firms are less willing to disclose pollution emissions information. We then regress the mediator against the dependent variable without including *GovEnv(ln)* as the predictor. Column 3 in Table 3 shows the results. The mediator's coefficient is 0.1144 and significant. Lastly, we regress both the main independent variable and the mediator against the dependent variable. Column 4 in Table 3 displays the results. The independent and mediating variables' coefficients are −1.0215 and 0.1043, respectively. The regression results demonstrate that the independent variable's direct effect was the most significant. The indirect effect is smaller, but it does exist.

The mediation effect demonstrates that enterprises want to be "free-riders" and avoid environmental responsibilities. An increase in fiscal environmental expenses decreases both environmental performance and disclosures, leading to a decrease in green investments. Enterprises may believe it is unnecessary to engage in green behavior because the

government has already done so. In turn, they will invest less in green programs that are not cost-efficient.

4.3. Heterogeneity Analysis

The previous section demonstrated the negative total effect of fiscal environmental expenditures on corporate green investments. However, does this effect exist in the subsample? By comparing the two subsamples' results, we can determine what kind of firm is more likely to reduce their green investments and avoid environmental responsibility. We divide the sample into three groups and conduct a heterogeneity analysis, then examine the differences between subsamples with different industry attributes, property rights, and districts.

The results reveal that the "crowding-out" effect disappears in heavily polluting and private corporations. This effect is significant for corporations in China's three major urban agglomerations; these corporations are either more strictly regulated or their green behaviors are influenced by the market. These results also provide implications in preventing corporations' free-rider behavior.

4.3.1. Industry Attributes

We first classify the sample by industry attribute or whether the firm belongs to a heavy-polluting industry. According to the "Guidelines for Environmental Information Disclosure of Listed Companies" (mee.gov.cn, accessed on 10 August 2021), sixteen industries are classified as heavy-polluting industries, including thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemical industry, petrochemical, building materials, papermaking, brewing, pharmaceuticals, fermentation, textiles, tanning, and mining. Such criteria are based on certain emission thresholds. These industries are expected to act differently compared to light-polluting industries, because policies are more restrictive toward the former; moreover, heavy-polluting industries are a primary producer of pollutants. During production, corporations in such industries emit three major industrial wastes—wastewater, exhaust gas, and solid waste—which are harmful to both ecology and health. Thus, policies clearly require local governments to increase environmental regulations on heavily polluting enterprises.

The Ministry of Ecology and Environment of China has established detailed emissions standards for these enterprises and regularly monitors their emissions. If these emissions exceed the standard, the firms are fined and must address the issue. Heavy-polluting enterprises must invest in clear production devices to reduce and reuse their pollutant emissions. Thus, the amount of fiscal environmental expenditures has less effect on heavy-polluting enterprises.

In contrast, other industries may be more sensitive to fiscal environmental expenses. As these industries' production processes are more environmentally friendly, the government focuses less on their environmental behavior. These firms' green behavior is more flexible, without clear requirements, such as energy-savings thresholds and improvements to the work environment. Further, they are more likely to act as "free-riders" than firms in heavy-polluting industries and reduce their green investments. Thus, we anticipate the negative effect from fiscal environmental expenditures to be greater for non-heavy-polluting industries.

Table 4, Column 1 presents the results, which are consistent with our expectations. Of the observations, 659 and 882 belong to the heavy- and light-polluting industry groups, with independent variable coefficients of 0.0839 and −0.7039, respectively. The effect in the non-polluting industry group is negative and the *p*-value is significant. Each 1% increase in fiscal environmental expenses causes the light-polluting companies' green investments to decrease by 0.739%. The coefficient for heavy-polluting companies is positive, but not significant.

Table 4. Heterogeneity analysis.

	(1)	(2)	(3)	(4)
	Non-Heavily Polluted	**Heavily Polluted**	**Privately Owned**	**State-Owned**
GovEnv(ln)	−0.7039 **	0.0839	0.3538	−0.5375 **
	(−2.2460)	(0.3110)	(0.7961)	(−2.1327)
SndIndGDP	0.0148	−0.0243	0.0151	−0.0107
	(0.7819)	(−1.4197)	(0.5047)	(−0.6975)
AvgGDP	0.0569	−0.1236 **	−0.1483	−0.0355
	(0.8261)	(−2.0515)	(−1.5043)	(−0.6588)
GovEnvTax	0.0000 *	−0.0000 **	−0.0000	−0.0000
	(1.6510)	(−1.9886)	(−0.0455)	(−1.0315)
$CO_2Emission$	−0.0000 *	0.0000	−0.0000	0.0000
	(−1.6918)	(1.0187)	(−1.3413)	(0.6205)
Asset(ln)	1.2594 ***	0.4045 ***	1.0332 ***	0.9290 ***
	(12.0558)	(4.2834)	(7.1173)	(10.5840)
ROA	5.5822 **	2.7118	3.1137	4.0909 **
	(2.0244)	(1.6229)	(1.0758)	(2.0802)
FixAssetRatio	0.7685	1.6079 **	2.6589 **	1.8214 ***
	(0.9971)	(2.4163)	(2.3203)	(3.3056)
RTRatio	−0.0000	−0.0000	−0.0003	0.0000
	(−0.2030)	(−0.0615)	(−0.4162)	(0.1263)
BoardSize	0.1946 ***	0.0315	0.1425 *	0.1667 ***
	(3.3817)	(0.6243)	(1.7126)	(3.5764)
MngAvgAge	0.0055	0.0669	0.0961	0.0241
	(0.1068)	(1.4330)	(1.5579)	(0.5027)
LevRatio	0.0320	0.0117	0.0104	0.0248 *
	(1.4881)	(1.2597)	(0.6928)	(1.9095)
AssetLiabRatio	−1.1091	0.8531	0.1472	0.6675
	(−1.2631)	(1.2629)	(0.1378)	(0.9846)
_cons	−2.5197	−0.7296	−17.5451 **	−0.4728
	(−0.4563)	(−0.1690)	(−2.3333)	(−0.1110)
$Prob > chi^2$	0.0559		0.0691	
Firm FE	Yes	Yes	Yes	Yes
N	882	659	422	1119
R-squared	0.3568	0.1675	0.3333	0.2570

Notes: We divide the sample into two groups for our heterogeneity analysis. We examine the differences between subsamples with different industry attributes (Columns 1 and 2) and property rights (Columns 3 and 4). The *t*-statistics as noted in parentheses are corrected for heteroscedasticity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The government has made a substantial effort to improve the environment, and corporations have the right to enjoy it. Under strict regulations, corporations should invest in green programs to realize clean production. In this case, heavy-polluting companies are likely to increase their green investments, because they are under strict environmental regulations, while light-polluting corporations have the chance to avoid such green behavior. Thus, detailed requirements and regulations are needed to avoid the "crowding-out" effect.

4.3.2. Property Rights

This section classifies our sample according to property rights; we expect that state-owned and private enterprises will act differently, and thus, we classify central and local state-owned enterprises as state-owned enterprises. Columns 3 and 4 of Table 4 present the regression results for the two groups. For state-owned enterprises, the negative effect of fiscal environmental expenses on green investments significantly differs from zero. Every percentage of increase in fiscal environmental expenses leads to a 0.54% decrease in green investments. In contrast, the coefficient of the independent variable in the private enterprise group is positive, although not significant. Therefore, privately owned enterprises intend

to take environmental responsibility. These two results indicate that a negative effect exists only for state-owned enterprises.

These results contradict our previously mentioned hypothesis. Compared with private enterprises, SOEs have stronger political ties to the government and are supposed to follow governmental policy guidelines and increase green investments if the government expects them to do so. However, without strict requirements and regulations, they might do the opposite because of their close connections with the government. Moreover, SOEs can learn about the government's policy earlier than private corporations, and can respond to such policies in advance to minimize potential losses. According to the "race to the bottom" phenomenon, the government may loosen regulations because of their importance in economic growth [4]. When environmental protection announcements are issued, if no strict process supervision exists, private corporations may act strictly according to policy requirements, while SOEs will not. Thus, it is more likely that SOEs will reduce their green investments given a lack of strict regulations.

Our results, which indicate that SOEs avoid more environmental responsibilities than private corporates, are different from previous literature. According to Zhang (2021), state-owned corporations show the more pronounced response to environmental regulation [78]. The different results are due to the different types of environmental regulation. Zhang (2021) introduced an environmentally related campaign to represent governmental regulation. Governmental performance is linked to the ecological effect of such a campaign. Thus, governors have strong incentives to improve environments, and SOEs face more government intervention when conducting green behaviors. Unlike the environmental campaign in Zhang (2021), we used fiscal environmental expense in our research. It is not a mandatory policy aimed at corporates. Besides, the effect on corporate green behaviors is difficult to quantify clearly as part of government environmental protection achievements. Thus, governors may not be motivated to interfere and supervise corporates' green behaviors. SOEs, with tighter links with governments, are more likely to avoid environmental responsibilities and reduce green investments.

These results indicate that SOEs spend less money on green investments as fiscal environmental expenses increase. In contrast, private corporations have no such negative relationship, as private property reduces the possibility of avoiding environmental responsibility.

4.3.3. Regional Differences

We now compare regional differences by classifying the sample in two ways. First, we categorize the provinces in which the company is located in the eastern, central, and western regions. Next, we classify the sample according to whether they belong to the three major urban agglomerations and test the subsample's significance.

The results of classifying enterprises as located in the eastern, western, and central districts are shown in Table 5, Columns 1 through 3. None of the differences were statistically significant. The central and eastern regions' coefficients are negative, while the western region's coefficient is positive, which contradicts our hypothesis (Table 6). The first reason for this result is that in more than 1000 samples, only 439 belonged to the central and western regions, and too few samples reduced the results' accuracy. Figure 3 also illustrates this phenomenon. Second, although the sample size appears to be sufficient in the eastern region, large differences can be observed between the samples. Substantial environmental and economic differences exist between the northern and southern areas within the eastern region, which may lead to insignificant results for this region. The difference in our results compared with the previous research may be caused by the different data samples. Zhu (2019) uses regional-level data and found that environmental efficiency in the western region is far worse than that in eastern China [91]. Our research is based on firm level, where most listed firms are located in three major agglomerations. Only a few listed firms are located in the central region, western region, and eastern region.

Table 5. Heterogeneity analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Eastern Region	**Central Region**	**Western Region**	**Non-Agglomeration**	**Three Major Agglomerations**	**Yangtze River Delta**	**Pearl River Delta**	**Beijing-Tianjin-Hebei Urban Agglomeration**
GovEnv(ln)	−0.2630	−0.6863	0.3602	0.3084	−0.7988 **	−1.8505 *	2.2459	1.8853
	(−1.0484)	(−0.4681)	(0.4137)	(0.7974)	(−2.2036)	(−1.8134)	(0.5322)	(0.9288)
SndIndGDP	0.0224	0.0746	−0.0519	−0.0009	−0.0119	0.2461	3.8190	0.0759
	(1.3888)	(1.0384)	(−0.8383)	(−0.0337)	(−0.4616)	(1.2844)	(0.9257)	(0.8580)
AvgGDP	0.0450	0.0110	−0.3070	−0.1240	0.0718	0.5719	14.8394	−0.7663
	(0.5694)	(0.0204)	(−0.7686)	(−1.2494)	(0.7325)	(1.2152)	(0.7846)	(−1.0568)
GovEnvTax	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	0.0000	−0.0000
	(−0.6674)	(−0.7720)	(−0.3499)	(−1.0410)	(−0.1335)	(−0.3965)	(1.2921)	(−0.4544)
CO_2Emission	−0.0000	0.0000	−0.0000	−0.0000	0.0000	0.0000	−0.0027	−0.0001
	(−0.1631)	(0.6614)	(−0.4192)	(−0.2703)	(1.5807)	(0.9426)	(−0.8420)	(−1.0019)
Asset(ln)	1.0092 ***	0.1421	1.0770 ***	0.7056 ***	1.0159 ***	1.1177 ***	0.7726 ***	1.1955 ***
	(11.6186)	(0.6624)	(4.4087)	(5.7165)	(10.6721)	(6.9037)	(3.0005)	(7.6059)
ROA	3.4215	9.4206 **	2.8385	3.0196	5.9607 **	13.6159 ***	3.4994	−5.1008
	(1.5747)	(2.2038)	(1.0268)	(1.6089)	(2.1063)	(3.6276)	(0.4224)	(−0.9031)
FixAssetRatio	0.8940	4.3652 ***	4.1945 ***	3.7500 ***	0.2860	0.1408	3.1540 *	0.8082
	(1.5020)	(3.2192)	(3.6394)	(5.7733)	(0.4063)	(0.1265)	(1.8370)	(0.6882)
RTRatio	0.0000	0.0017	0.0000	0.0000	−0.0001	−0.0172 ***	−0.0000	−0.0001
	(0.1018)	(1.1592)	(0.8441)	(0.0030)	(−0.5167)	(−3.1762)	(−0.0341)	(−0.0115)
BoardSize	0.1930 ***	0.0834	−0.0310	0.0258	0.2220 ***	0.1650	0.1874 *	0.2285 ***
	(4.0478)	(0.7590)	(−0.2713)	(0.4162)	(4.2569)	(1.5668)	(1.6956)	(2.8378)
MngAvgAge	0.0424	0.0836	0.0149	0.1051 **	0.0084	0.0201	0.1700	−0.1224
	(0.9591)	(0.8084)	(0.1570)	(1.9826)	(0.1631)	(0.2457)	(1.3830)	(−1.4513)
LevRatio	0.0244 **	−0.0006	0.0501	0.0200 *	0.0285	0.0255	−0.1191	0.0382
	(2.1149)	(−0.0198)	(1.4474)	(1.7780)	(1.6158)	(0.8945)	(−1.6462)	(1.6109)
AssetLiabRatio	−0.2598	4.4975 ***	−1.0683	0.5508	0.0535	−0.0774	1.1736	−0.3865
	(−0.3709)	(2.9838)	(−0.8238)	(0.7332)	(0.0641)	(−0.0620)	(0.5741)	(−0.2614)
_cons	−7.3586 *	3.4923	−9.5329	−11.4592 **	0.7973	−5.6523	−163.1725	−23.4173
	(−1.6854)	(0.1687)	(−0.8280)	(−2.0505)	(0.1252)	(−0.3764)	(−1.2901)	(−0.9800)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1102	219	220	700	841	342	188	311
R-squared	0.3003	0.2354	0.2472	0.1875	0.3421	0.3350	0.2942	0.4447

Notes: We divide the sample into two groups and conduct a heterogeneity analysis. We examined the differences between samples in the eastern, central, and western areas (Columns 1, 2, and 3), and the differences between samples within and outside the three major agglomerations (Columns 4 and 5). We further examine the subsample in the Yangtze River Delta, Pearl River Delta, and Beijing–Tianjin–Hebei Urban Agglomeration (Columns 6, 7, and 8). The *t*-statistics as noted in parentheses are corrected for heteroscedasticity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Hypothesis and conclusions.

Hypothesis			Conclusions
H1	**H1a**	**Confirmed**	Government environmental spending negatively influences firms' green investments.
	H1b	**Rejected**	
H2	**H2**	**Confirmed**	An increase in fiscal environmental expenses decreases both environmental performance and disclosures, leading to a decrease in green investments.
H3	**H3a**	**Confirmed**	Heavily polluting companies are likely to increase their green investments because they are under strict environmental regulations, while light-polluting corporations have the chance to avoid such green behavior.
	H3b	**Rejected**	SOEs spend less money on green investments as fiscal environmental expenses increase.
	H3c	**Partially confirmed**	The central and eastern regions' coefficients are negative, while the western region's coefficient is positive, which contradicts our hypothesis. The "crowding-out" effect is larger in the three major agglomerations, but especially in the Yangtze River Delta.

Figure 3. China's average fiscal environmental protection expenditures and corporate green investments (2009–2020).

We examine the impact more closely by dividing the samples according to whether they were in one of China's three major urban agglomerations: the Yangtze River Delta, Pearl River Delta, and Beijing–Tianjin–Hebei Urban Agglomeration. The economic and environmental conditions in these three agglomerations are similar to those in the other districts. Figure 3 indicates that the average fiscal environmental expenditures in the three regions has been greater than that in other regions in the past 10 years. The enterprises' response to fiscal environmental expenditures in these regions may be clearer and more accurate. Table 5, Columns 5 and 6 reveal that environmental expenditures have a significant, negative impact on corporate green investments in the three major agglomerations, while the other groups' coefficients are insignificant and positive. The results indicate that enterprises in more developed regions tend to avoid environmental responsibilities and reduce green investments if governmental environmental spending increases. This may be because listed companies are more densely located within the region, and it is more difficult for the government to regulate them. Additionally, we cannot rule out the emergence of the "race to the bottom" as a result of government interactions.

We further examined the impacts of the samples located in the Yangtze River Delta, Pearl River Delta, and Beijing–Tianjin–Hebei Urban Agglomerations to discover that only corporations located in the Yangtze River Delta exhibit significant, negative responses to the increase in environmental expenditures; the coefficient for this agglomeration is larger than the baseline results. The "crowding-out" effect is larger in the three major agglomerations, but especially in the Yangtze River Delta.

5. Conclusions

With a recent emphasis on ecological environmental protections and decreasing carbon emissions, literature has increasingly examined the impacts of government environmental spending and environmental regulations. Accordingly, researchers have attempted to relate government regulations to various consequences, such as ecological environment quality, economic growth, corporate green innovation, and environmental protection performance. Our study extends this research by empirically proving the relationship between government environmental expenditures and corporate environmental protection investments.

Our study's primary research question is whether the government's fiscal environmental protection expenditures "promote" or "crowd out" corporate green investments. Our results indicate a significantly negative relationship between fiscal environmental protection expenditures and corporate green investments, and this relationship is more pronounced in our instrumental variable test. The results imply that the input from fiscal environmental protection expenditures "crowds out" corporations' green investments.

We further investigated the channels through which fiscal environmental expenditures affect corporate green investments to demonstrate that pollutant emissions disclosures are one mechanism by which government environmental spending negatively impacts corporate green investments. To further analyze the results, we split the sample three ways according to industry attributes, property rights, and geographical location. The results reveal that the "crowding-out" effect is more pronounced in light-polluting companies, state-owned companies, and companies located in China's three major urban agglomerations, and especially those in the Yangtze River Delta.

Our study contributes to current literature by providing new insights regarding government environmental protection behaviors' impacts on corporate green behaviors. Literature identifies this effect in terms of a government's environmental policy, supervision, and regulation. We augment this literature by providing another important government-level dependent variable: fiscal environmental protection expenditures. Our study further contributes to literature on corporate environmental responsibility by providing new evidence for fiscal environmental spending's positive impact on corporate green investments.

This study also offers important implications for policymakers. We discovered that fiscal environmental expenditures have significantly negative impacts on corporate green investments, and the results are mediated by pollution emissions disclosures. This may provide insights to improve the government's awareness of corporate green investment behaviors when developing environmental protection policies. Additionally, the negative impact is significant for light-polluting corporations, while it disappears in heavy-polluting corporations. The results indicate that when heavy-polluting corporations are regulated by stricter environmental requirements, they are more environmentally responsible, while light-polluting corporations avoid green investments altogether.

The results may provide insights for policymakers to focus more on light-polluting corporations. Policies and action plans should be proposed to encourage and supervise such corporations' environmental responsibility. This study also indicates that state-owned corporations tend to avoid environmental responsibility more than private corporations. The results can assist policymakers in considering government–enterprise relationships when making environmental protection-related policy decisions. Finally, as the negative effect is more significant for corporations located in China's three major urban agglomerations, policymakers must balance the relationship between economic development and supervising enterprises' environmental activities.

Our research is based on data from China, where the government must still strengthen its environmental regulations and enterprises' CER performance must improve. Therefore, our research results may differ from those of corporations in developed countries. This topic is worth exploring in the future.

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