Political Connection and Environmental Protection Investment: A Study Based on Ownership Difference

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Abstract: Using data from listed firms in the pollution-intensive industries in China from 2009 to 2019 and taking into account ownership differences, our study examines the causal effect of political connections on environmental protection investment behavior. To deal with the potential endogeneity concern, we created a quasi-natural experiment based on an anti-corruption campaign in China that prohibited officials from holding business positions. Our results indicate that political connections increase environmental protection investment in state-owned firms, primarily when the politically connected director (is affiliated) participates in the firm's daily operations. However, in non-state-owned firms, political connections hinder environmental protection investment, and, furthermore, investment decreases as the administration level of the politically connected directors increases. Additionally, we also found that local regulatory intensity strengthens the impact of political connections on environmental protection investment. While the study uses China's firms as the sample, the findings may also apply to other emerging economies.

Keywords: political connection; environmental protection investment; quasi-natural experiment

1. Introduction

In recent decades, concerns about the negative impact of economic and social development on the environment have attracted significant attention from both entrepreneurs and governments, particularly in emerging economies. The issue of environmental pollution resulting from rapid growth poses a significant threat to sustainable development. A large amount of literature has been devoted to the research on sustainable development, and their contributions are significant [1–5]. Therefore, politicians are expected to undertake more measures to monitor firms and protect the environment. However, in emerging economies, political connections between commercial firms and the government are prevalent due to incomplete market mechanisms and the lack of law enforcement. The connection between the government and corporations may have two different influence patterns on a corporation's behavior. On the one hand, an insider in a corporation may help the government better monitor the corporation's behavior. On the other hand, this connection may help the corporation seek favorable treatment from the government, ultimately hindering government monitoring. Considering that different ownership may significantly change the influence pattern, we investigate the potential impact of political connections on corporations' environmental protection behavior in state-owned and non-state-owned settings. Our study aims to examine the relationship between political connections and environmental protection investment, thereby contributing to the literature on environmental sustainability and economic development in emerging markets.

With increasingly strict environmental governing concerns, enterprises face a dilemma: invest more in environmental protection to comply with minimum standards set by the administration or pay the higher cost of penalties [6–8]. Although existing literature has examined the relationship between external environmental regulation and firm environmental protection investments [9–14], the impact of internal governance mechanisms on

investment behavior has been largely underestimated. These factors play a crucial role in analyzing corporate environmental protection investment behavior. In China, it is common for a former or current government official to serve as a manager or director of a listed company, and such individuals can influence a company's behavior and performance [15–19]. That influence may be changed by a company's ownership [20–23]. Moreover, our study may have general implications because of the phenomenon of political connections in many countries.

While current literature focuses on the role of managers' political connections, little attention has been paid to the directors' political connections, and our research aims to fill this gap. Directors are often regarded as an institutional arrangement to address agency problems [24]. Apart from supervising management [25,26], directors play a crucial role in a company's investment decision-making [27,28] and provide critical relational resources for its long-term development [29]. The study of enterprise behavior has shed light on how board structure affects enterprises [30]. Board structure typically includes board size, the proportion of independent directors, age structure, and gender composition of the directors, as well as their professional background [31,32]. Recently, more works have paid attention to a specific board structure, politically connected directors with administrative backgrounds on the board [33]. As a link between government and enterprises, politically connected directors can affect company performance, and there are two opposing views on this issue. Some argue that politically connected directors can establish a beneficial political connection and improve enterprise performance by providing relational resources and taking advantage of the government's policy [34–37]. Other literature contends that politically connected directors are a significant channel for government intervention in enterprises. Companies with politically connected directors often undertake more political goals, lowering enterprise performance. In light of the study conducted by Xiao and Shen (2022) [38], which focused on the impact of political connections on environmental protection investment, it is important to note that their research did not take into account the ownership structure of the companies involved. However, ownership identity can significantly alter the mechanism through which politically connected directors affect environmental protection investment. Ownership differences play a crucial role in corporate governance and can have a substantial influence on the operations of companies, particularly in the context of China [39]. China's capital market consists of both state-owned and non-state-owned enterprises, providing an ideal setting to explore how political connections impact environmental protection investments in corporations with varying ownership structures. By considering this aspect, our research aims to contribute to a more comprehensive understanding of the relationship between political connections and environmental practices in different types of companies.

State-owned enterprises bear more social responsibilities and policy burdens than non-state-owned enterprises and face greater government intervention [40]. Despite the greater government intervention, state-owned enterprises enjoy government paternalism, which provides them with financial subsidies, increased loans, or lower taxes when they suffer losses [41,42]. Due to the increasingly severe issue of environmental pollution, local governments face growing pressure from residents and central authorities to improve environmental conditions and reduce pollution. As a result, politically connected directors in state-owned and non-state-owned enterprises have distinct impacts on corporate environmental protection investment behavior. In non-state-owned companies, politically connected directors are viewed as resource providers, while in state-owned companies, they are often perceived as supervisors. Therefore, it is necessary to distinguish the mechanisms employed by companies with different ownership structures. In state-owned enterprises, politically connected directors may serve as a channel for government intervention in corporate behaviors as the government appoints them. Such directors will likely take additional responsibilities on public issues like environmental protection to reduce the government's burden and advance their political careers. Consequently, politically connected directors in state-owned enterprises often act as "supervisors of the government".

In contrast, owners of non-state-owned enterprises expect politically connected directors to use their political resources to lower operating costs and avoid regulation, which amounts to political rent-seeking behavior. In non-state-owned companies, politically connected directors typically serve as "relational resource providers". This tendency is particularly pronounced when the local government has stronger economic growth and financial pressures.

This paper examines the impact of politically connected directors on corporate environmental protection investments in China's pollution-intensive industries. To investigate the impact mechanisms of different types of corporations, we classified them the corporations as state-owned and non-state-owned based on final control rights. To address potential endogeneity problems, we utilized Regulation 18 as a quasi-natural experiment to investigate how it affected corporate board structure and, ultimately, corporate environmental protection investments between 2009 and 2019. In 2013, Regulation 18 was introduced by the central government with the objective of fighting corruption by prohibiting officials from holding positions in commercial firms. The strict enforcement of this regulation has resulted in a significant number of politically connected directors relinquishing their business positions. Our findings indicate that state-owned enterprises invested more in environmental protection than non-state-owned enterprises. Politically connected directors positively promote corporate environmental protection investments in state-owned enterprises, especially when they hold affiliated director positions. Conversely, politically connected directors in non-state-owned enterprises reduce environmental protection investment. We also find that higher-ranking officials are associated with lower levels of environmental protection investment in non-state-owned enterprises. Under the political shock caused by Regulation 18, the level of environmental protection investment in state-owned enterprises decreased significantly, while that of non-state-owned enterprises increased significantly.

This study can significantly contribute to the existing literature in several ways. Firstly, environmental protection is currently one of the most critical issues in emerging markets, and enterprises have a crucial role to play in addressing this challenge. As a primary consumer of environmental resources and producer of pollution, the enterprise is a key stakeholder in environmental protection. Therefore, it is essential to identify enterprises' roles in this regard. Through our analysis of the motivation behind investments in environmental protection and considering the relationship between political connections and corporate behaviors, we can provide valuable insights into the government on how to motivate enterprises to assume greater responsibilities for environmental protection. Secondly, our study delves into the unique functions fulfilled by politically connected di-rectors in firms with different ownership structures. This contributes to the existing body of research on the association between political connections and corporate actions and offers evidence regarding the theoretical mechanisms by which politically connected di-rectors influence business practices. By examining these factors, we aim to provide a more comprehensive understanding of the complex relationship between political connections and corporate behavior. Finally, our study employs Regulation 18 as an exogenous shock to address potential endogeneity issues in the relationship between political connections and company behaviors. This approach may offer an effective method for mitigating endogeneity concerns in similar research. Briefly, our findings provide new and valuable insights into the intersection of ownership, political connections, and environmental protection in China and other emerging markets.

2. Background and Hypothesis Development

2.1. Research Background

China's economic growth has surged over the past decades since the inception of its reform and opening-up policy. This growth can be attributed to China's distinctive political structure and interregional competition system in the political arena [43]. The central government has the authority to appoint local government officials. For a long time, economic indicators, particularly local GDP growth, have been used as selection

and promotion criteria for local government officials [44]. The Chinese government's administration system features a typical pyramid structure, which means the central government dominates the whole system [45]. The evaluation mechanism set by the central government promotes regional competition among local governments, bringing significant growth in industrialization and GDP. However, the mechanism has failed to address environmental protection and sustainable development concerns. Despite the significant economic expansion following the implementation of the reform and opening-up policy, the adverse impact of environmental pollution has become increasingly severe. Particularly, China has faced great international pressure in these years due to international agreements like the Kyoto Protocol and the Paris Agreement. Environmental protection has become one of the most pressing issues for the Chinese government. Therefore, as one of the most pressing issues, environmental protection has been prioritized as a fundamental state policy by the Chinese government [46,47]. The governmental performance evaluation system has now integrated the improvement of ecological civilization, which means that it potentially affects the political career of local officials.

Under the principle of "Those who produce pollution must bear the burden of recovery and protection", the Chinese government forces enterprises to take the majority of the responsibilities for environmental protection. In the past decade, China has introduced several policies and regulations to mitigate environmental pollution, resulting in a surge in enforcement actions against corporations. Consequently, corporations have had to increase their investment in environmental protection to comply with the minimum regulatory standards. Despite existing regulations, environmental protection investment by Chinese listed companies remains low [48,49]. There are several factors as follows that may explain why Chinese listed companies are hesitant to invest in environmental protection. Firstly, environmental protection investments generate social benefits that all market participants can share. Additionally, environmental protection investment increases corporate operating costs and reduces corporate competitiveness [50]. Secondly, Chinese investors do not emphasize corporate social responsibility performance much, and the stock market cannot provide negative feedback to environmental pollution events. Thirdly, environmental protection investment requires significant liquidity support [51], which is difficult for Chinese listed companies to obtain due to financing constraints in the Chinese capital market [52].

2.2. Hypothesis Development

2.2.1. The Influence of Politically Connected Directors on Environmental Protection Investment in State-Owned Enterprises

China's state-owned enterprise reform aims to enhance the competitiveness of state-owned enterprises, for which the government has formulated a new strategy. This involves creating state-owned asset management companies and enterprise groups that alter the government's control mechanism. The government attempts to shift from direct to indirect control by constructing state-owned asset management companies and enterprise groups. Although the structure improves state-owned companies' performance, it has the unintended consequences of weakening the government's control over these enterprises and escalating the costs incurred by the government to intervene in their operations [53].

The promotion of local officials is determined by a comprehensive evaluation system, which covers various aspects such as economic development, social stability, and environmental protection. The local official must outperform their peers to succeed in the evaluation process. In this regard, state-owned enterprises play a significant role in their work. However, this creates policy pressure, making the government hesitant to relinquish control over state-owned enterprises. Despite the new structure weakening the government's control, it still retains the right to appoint directors to these enterprises. As a result, politically connected directors are often appointed to the boards of state-owned enterprises, as it has become an effective method for the government to maintain control over them [47].

Politically connected directors can be classified into two categories: retired and current. Retired directors are often concerned about their retirement benefits and tend to act cautiously to avoid political risks [36]. Therefore, catering to government policies becomes one of the best choices for them to deal with political risks. In contrast, current politically connected directors still have opportunities for further promotion. Working in state-owned enterprises may be a temporary strategy for them to navigate political turbulence or a test from higher-ups. In either case, their work must align with the government's needs and meet the evaluation system's criteria for the promotion. As a result, current politically connected directors also tend to meet government policy needs. In summary, politically connected directors in state-owned enterprises often serve as government supervisors. Therefore, this paper proposes the following Hypothesis 1.

Hypothesis 1. *In state-owned enterprises, the existence and the increasing proportion of politically connected directors on the board have increased corporate environmental protection investment.*

2.2.2. The Influence of Politically Connected Directors on Environmental Protection Investment in Non-State-Owned Enterprises

Since the 1980s, non-state-owned enterprises in China have experienced significant growth and have become an integral part of the emerging market. However, China's market mechanism and legal system are still not fully developed, and the private economy faces discrimination in terms of government policies and legal protection [54]. In contrast, state-owned enterprises have an inherent advantage due to their close relationship with the government, which provides them with greater access to resources, such as financing assistance, lower entry barriers into regulated industries, and government subsidies [55]. Despite these challenges, non-state-owned enterprises have been able to compete with state-owned enterprises with the help of a better stimulation system.

State-owned enterprises often pursue diverse operational objectives, while non-state-owned enterprises focus primarily on maximizing corporate value. Therefore, when hiring a manager, non-state-owned enterprises prioritize the capability to generate profits. The board members play a critical role in the corporate senior management structure. They provide two important resources for corporate development: knowledge resources represented by the directors' personal experiences and professional skills [56,57] and social relational resources used to exchange external information and obtain external support [29]. In general, board members are chosen based on their ability to contribute to the company's growth and success rather than any other factors, such as political connections.

In Chinese traditional culture, relational resources hold significant value, particularly those from the government [58,59]. Politically connected directors, who understand government workings and policy interpretation, are a valuable resource for non-state-owned enterprises. Unlike with state-owned enterprises, a structural hole exists between non-state-owned enterprises and the government. The structural hole is a disconnect between two groups that do not interact closely [60–63]. Politically connected directors in non-state-owned enterprises often occupy this position and connect non-state-owned enterprises and social resource centers such as governmental agencies. As a result, non-state-owned enterprises are willing to offer high salaries to hire politically connected directors, hoping to obtain political benefits like tax reductions, government subsidies, and administrative permits for regulated industries. Consequently, politically connected directors in non-state-owned enterprises are considered "relational resource providers".

Smart business owners consider both the cost and income of environmental protection. However, the cost of environmental protection investments is considerably higher than the cost of regular enterprise equipment investments. Certain essential environmental protection investments, such as those in environmental protection facility construction and environmental protection technology upgrading, can consume a significant portion of a company's cash, which significantly burdens non-state-owned enterprises. Despite environmental protection investments offering a large portion of social benefits shared

among residents, the government, and market participants, such investments rarely provide direct economic benefits to the enterprises themselves.

As a result, non-state-owned enterprises are often unwilling to make environmental protection investments in order to increase their profits. However, as environmental laws and regulations continue to improve, the cost of violating environmental regulations rises, and thus enterprises are forced to increase their environmental protection investments [6,64]. Compared with state-owned enterprises, non-state-owned enterprises are more vulnerable to enhanced environmental regulations. To mitigate the impact of stricter environmental regulations and avoid costly environmental protection investments, non-state-owned enterprises preferably tend to establish political connections.

Politically connected directors can serve as valuable "relationship resource providers" in non-state-owned enterprises by bridging the gap between these businesses and the government, shielding them from potential government exploitation. This link has been shown in studies, such as Fisman and Wang (2015) [65], which found that enterprises with political connections are rarely punished for environmental pollution. This can be explained by the fact that these connected enterprises have ways to deal with local government oversight. Furthermore, even after punishment decisions have been made, politically connected enterprises can still overturn or avoid them through their connections with authorities [66]. The effectiveness of relationship resources provided by politically connected directors in non-state-owned enterprises depends on the quality of their relationships. Each individual's social resource network has limitations, and different people have different relationship networks based on their experiences, personalities, and preferences. By having more politically connected directors in a non-state-owned enterprise, communication channels between the business and the government can be broadened, which allows them to avoid environmental regulation and reduce environmental protection investments. Based on this analysis, we propose Hypothesis 2.

Hypothesis 2. *In non-state-owned enterprises, the existence and the increasing proportion of politically connected directors on the board lead to lower corporate environmental protection investment levels.*

We present the hypothesized conceptual model that demonstrates the structure of the two hypotheses in Figure 1.
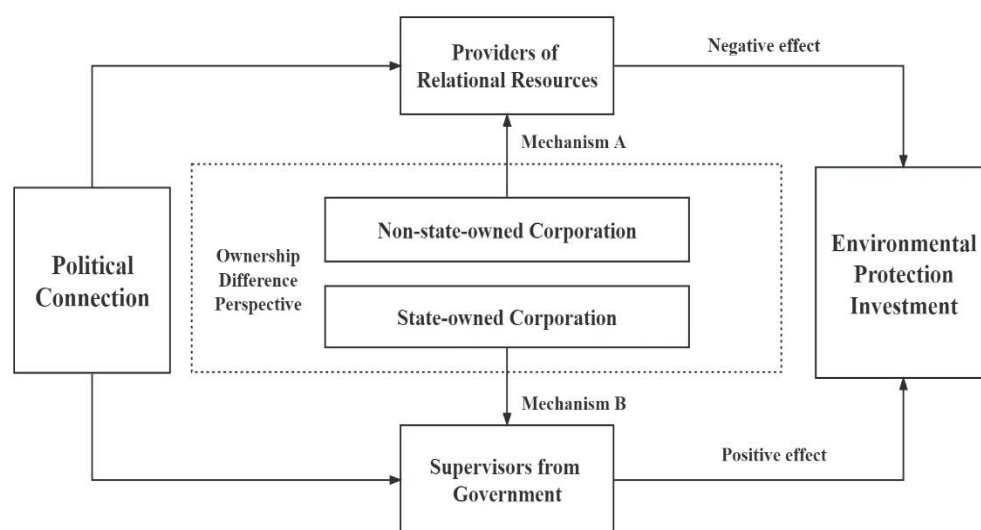
Figure 1. Hypothesized conceptual model.

3. Data and Empirical Models

3.1. Data and Sample Selection

To effectively address the issue of environmental pollution, it is essential to focus on the sources of pollution. Specific industries, known as pollution-intensive industries, are responsible for most pollution. To identify these industries, we refer to the definitions from two Chinese government documents, namely the Notice on Performing Environmental Protection Examination of Enterprises Applying for IPO or Refinancing (H.F. [2003] No. 1010) and the Management List of Environmental Protection Examination of Listed Companies Classified by Industries (H.B.H. [2008] No. 373). Furthermore, based on the industry categorization outlined in the Guidelines for the Industry Classification of Listed Companies (CSRC 2001), we identify eight industries as being pollution-intensive in our research: the mining industry, metal and nonmetallic industry, petrochemical plastics industry, biochemical industry, water electricity and gas industry, textile, apparel and fur industry, food and beverage industry, and papermaking and printing industry.

Our research focuses on pollution-intensive industries in the Shanghai and Shenzhen A-share markets. We collect data from 2009 to 2019, including corporate environmental protection investment data from corporate social responsibility reports, sustainability reports, and environmental reports. Additionally, we manually collect the political backgrounds of corporate board members from the corporation governance dataset in the CSMAR database. Other data in our study are obtained directly from the CSMAR database. To ensure the effectiveness of our data, we exclude certain samples: (1) ST (Special Treatment) enterprise-year samples; (2) enterprise-year samples if their cash ratio >1, asset-liability ratio >1, and ROA <0; and (3) enterprise-year samples with missing values. Finally, there are 1533 enterprise-year samples remaining. To avoid interference caused by extreme outliers, all continuous variables are winsorized on the 1% and 99% quantiles.

3.2. Model Specification and Variable Description

1. Dependent variable (EPI)

Environmental protection investment (EPI) = (increased environmental protection investment of current year)/(total assets at the end of the current year) (we also did a robustness test on increased environmental protection investments of current year-beginning total assets ratio as the environmental protection investment level). The increased environmental protection investment refers to the increased environmental protection investments disclosed in corporate social responsibility reports, sustainability reports, and environmental reports. We set the content of the environmental protection investment as follows: investment in the construction of an environmental protection facility, investment in environmental protection technology development, investment in pollution control, expenditures for environmental protection equipment operation, environmental protection taxes, ecological protection cost, environmental protection training cost, environmental report preparation cost, and donations made by enterprises to environmental protection fund(s).

2. Independent variable

    a. Ownership of the enterprise (SOE)

Enterprises are divided into state-owned and non-state-owned enterprises based on their ownership of final control rights. The SOE value is 1 for state-owned enterprises and 0 for non-state-owned enterprises.

    b. The political connection of the director (PD)

The indicator is divided into PD_Dummy and PD_Ratio, representing the existence (PD_Dummy) and proportion (PD_Ratio) of politically connected directors on the board. Regarding the methods of [67,68], we set the existence of politically connected directors on a board as a dummy variable: when a board includes one or more directors who ever worked or are working for any government, the PD_Dummy value is 1, and otherwise, it is

set as 0. We calculate the proportion of politically connected directors (PD_Ratio) on the board as another dimension for examining board structure according to the ratio of the number of politically connected directors to the number of board members in an enterprise.

3. Control variables

With reference to the studies made by Chen (2011) [47], the control variables selected in this paper include enterprise size, measured by the natural logarithm of enterprise assets; financial lever (Lev), measured by the enterprise asset-liability ratio; cash flow (CF), measured by the net operating cash flow-total assets ratio; cash holding (Cash), measured by cash and the cash equivalents-total assets ratio; years since firm's IPO (Age), measured by the difference between the research year and the enterprise listed year; enterprise performance (ROA), measured by the return on total assets; investment opportunity (Firm_Q), measured by the value of the enterprise's Tobin's Q, equal to (the market value of equity + the book value of liabilities)/total assets; equity return (RET), measured by the annual equity investment return as adjusted by the market investment return; and management expenses ratio (Cost), measured by the management expenses-operating revenue ratio. The shareholding ratio of the first largest shareholder (TOP1), the shareholding ratio of the second to fifth largest shareholders (TOP2_5), the natural logarithm of board size (Boardsize), and whether the chairman is also the CEO (DUAL) are all included as control variables in this paper.

3.3. Research Model

To investigate the causal effect of political connections on firms' environmental protection investment behavior, we follow [69,70] to conduct the following baseline regression model (1).

$$EPI_{i,t} = \beta_0 + \beta_1 Indicator_{i,t-1} + \sum \beta_k ControlVars_{i,t-1} + \varepsilon \tag{1}$$

where $EPI_{i,t}$ represents the environment protection investment of firm i in year t; $Indicator_t$ represents a variety of independent variables of firm i in year t; β represents coefficients; and ε represents the residual term. Considering heteroscedasticity and the sequence of panel data, this paper made cluster adjustments for standard errors at the firm level. Year-fixed and industry-fixed effects have also been controlled for.

4. Political Connection and Enterprise Environmental Protection Investment

4.1. Baseline Regression Results: Political Connection and Enterprise Environmental Protection Investment

4.1.1. Descriptive Statistics Analysis

Figure 2 shows the yearly distribution of mean value in corporate environmental protection investment (EPI). We can see an overall upward trend in corporate environmental protection investment, especially after 2013, and the maximum mean value of corporate environmental protection investment is 0.00824 in 2018.
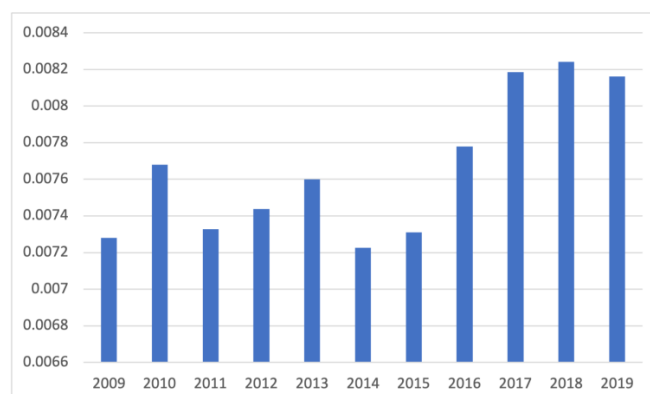
Figure 2. EPI Yearly Distribution.

Table 1 reports the descriptive statistics of the main variables. From 2009 to 2019, the mean value of state-owned corporate environmental protection investment (EPI) in Pollution-intensive Industries is 0.00801, higher than the mid-value, 0.00603. The mean value of non-state-owned corporate environmental protection investment (EPI) of Pollution-intensive Industries is 0.00715, higher than the mid-value, 0.00452. State-owned enterprises invest more in environmental protection than non-state-owned enterprises. Furthermore, the difference between the maximum and minimum values of environmental protection investment is significant, regardless of whether the enterprise is state-owned or non-state-owned. This suggests significant individual differences in corporate environmental protection investment behavior, which allows us to investigate further the factors influencing corporate environmental protection investment behavior.

Table 1. Descriptive statistics analysis.

	State-Owned Enterprise				Non-State-Owned Enterprise			
Variables	Mean	Minimum	Median	Maximum	Mean	Minimum	Median	Maximum
EPI	0.00801	0.00001	0.00603	0.05870	0.00715	0.00001	0. 00452	0.05041
PD_Dummy	0.56517	0.00000	1.00000	1.00000	0.64337	0.00000	1.00000	1.00000
PD_Ratio	0.09203	0.00000	0.10296	0.57764	0.10874	0.00000	0.08123	0.50587
Firm_Q	1.53858	0.81005	1.44522	5.15439	1.90807	0.82377	1.48250	5.42617
CF	0.06135	−0.12945	0.05764	0.24548	0.06768	−0.10068	0.06234	0.23575
ROA	0.04320	0.00000	0.06028	0.33975	0.19412	−0.37113	0.10049	0.27270
Cash	0.09718	0.01120	0.09512	0.49798	0.16540	0.02916	0.12846	0.41154
Age	2.85895	0.69315	2.83321	3.25810	1.98245	0.69315	2.39790	3.21888
Cost	0.06532	0.00919	0.05018	0.19484	0.08115	0.01548	0.06030	0.18669
Size	26.68019	19.52406	23.68181	27.44961	23.66353	20.39068	25.73628	26.09942
Lev	0.48774	0.07278	0.47123	0.85746	0.37251	0.07306	0.40341	0.87822
RET	−0.06184	−0.76482	−0.11501	1.37814	−0.01899	−0.76594	−0.03098	1.32757
TOP1	0.45032	0.09106	0.37785	0.87192	0.23553	0.09610	0.27465	0.71975
TOP2_5	0.14362	0.00747	0.10965	0.54590	0.23167	0.01106	0.15748	0.47653
BoardSize	2.47483	1.79176	2.39790	2.77259	2.18588	1.79176	2.30259	2.83321
DUAL	0.08104	0.00000	0.00000	1.00000	0.14708	0.00000	0.00000	1.00000

The mean value of PD_Dummy in state-owned enterprises is 0.56517, and the mean value of PD_Dummy in state-owned enterprises is 0.64337. We can see that in pollution-intensive industries, over 50% of enterprises hire politically connected director(s). The mean value of the proportion of politically connected director(s) in a board of state-owned enterprises is 9.203%. The mean value of the proportion of politically connected director(s) in a board of state-owned enterprises is 10.874%. On average, if the number of directors on the board of pollution-intensive industries exceeds 11, there will be at least one politically connected director. Therefore, it is worthwhile to investigate the influence of politically connected directors on corporate behavior, particularly investment in environmental protection.

4.1.2. Univariate Analysis Based on Ownership Difference

Table 2 shows the univariate testing result of the corporate's EPI based on ownership difference considering the political connections. We can see the following: In the non-state-owned enterprises' group, enterprises with a politically connected director have a lower EPI level, both in mean and median, and this difference is statistically significant at the 1% level according to the T-statistic and Z-statistic. In the state-owned enterprise group, enterprises with politically connected directors have a higher EPI level, both in mean and median, and this difference is statistically significant at the 1% level according to the T-statistic and Z-statistic.

Table 2. Univariate analysis.

Category Method			Environment Protection Investment (EPI)			
			Mean	T-Stat.	Median	Z-Stat.
Categorized by PD_Dummy	Non-SOE	PD_Dummy=0	0.00899	2.887 ***	0.00654	3.090 ***
		PD_Dummy=1	0.00484		0.00247	
	SOE	PD_Dummy=0	0.00596	−3.255 ***	0.00352	−3.27 ***
		PD_Dummy=1	0.00937		0.00698	
Categorized by PD_Ratio	Non-SOE	PD_Ratio<Median	0.00905	3.087 ***	0.00654	3.213 ***
		PD_Ratio≥Median	0.00464		0.00247	
	SOE	PD_Ratio<Median	0.00614	−3.517 ***	0.00399	−2.966 ***
		PD_Ratio≥Median	0.00975		0.00723	

Notes: The t- and Wilcoxon z-tests are employed to compare the mean and median difference, respectively. and *** denote significance at the 1% levels (two-tailed).

To better analyze the relationship between the proportion of politically connected directors on the board and the EPI, we divided the sample into two groups based on the median proportion of politically connected directors on the board. We can see the following result in the relationship between the politically connected director's proportion in the board and the EPI: In the non-state-owned enterprise group, enterprises with a higher proportion of politically connected directors on the board have a lower EPI level, both in mean and median, and this difference is statistically significant. In the state-owned enterprise group, enterprises with a higher proportion of politically connected directors on the board have a higher EPI level, both in mean and median, and this difference is statistically significant. These findings provide positive support for hypotheses 1 and 2 that we previously proposed.

4.1.3. Baseline Regression Results

Considering ownership difference, Table 3 shows the empirical findings of the relationship between political connection and EPI. As previously discussed, the enterprise's political connection is measured by the background of the politically connected directors on the board. Columns 1–3 show the regression results for the all-sample group; the SOE coefficients are positive and significant at the 1% level. This means that state-owned enterprises have a higher EPI level than non-state-owned enterprises. Because both the coefficients of PD_Dummy and PD_Ratio are positive but not statistically significant, further investigation is required to explain the effect of political connection on EPI.

To further investigate the impact of political connections on environmental protection investment, we divide the sample into two groups based on ownership difference. Columns 4 and 5 show the regression results for the state-owned enterprise group; the coefficients of PD_Dummy and PD_Ratio are 0.0035 and 0.0133, with significance levels of 1% and 5%, respectively. This suggests that the presence and increasing proportion of politically connected directors in SOEs have a positive impact on their investment in environmental protection. At the same time, this economic effect is also significant. With PD_ Dummy, for example, compared to state-owned enterprises without political affiliation, the environmental protection investment of state-owned enterprises with political affiliation will increase by 43.70%.

Columns 4 and 5 show the regression results for the non-state-owned enterprise group. The PD Dummy and PD Ratio coefficients are both negative, with significance levels of 5% and 1%, respectively. This suggests that the presence and increasing proportion of politically connected directors in non-SOEs have a negative impact on their investment in environmental protection. This economic effect is also significant; with PD_Dummy, for example, compared to non-state-owned enterprises without political affiliation, the envi-

ronmental protection investment of non-state-owned enterprises with political affiliation will decrease by 61.13%.

Table 3. Baseline regression results.

Dependent Variable: EPI	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All Sample			SOE		Non-SOE	
SOE	0.0045 ***	0.0044 ***	0.0044 ***				
	(3.46)	(3.44)	(3.46)				
PD_Dummy		0.0009		0.0035 ***		−0.0048 **	
		(0.90)		(3.34)		(−2.19)	
PD_Ratio			0.0034		0.0133 **		−0.0199 ***
			(0.64)		(2.25)		(−2.71)
Firm_Q	0.0010	0.0010	0.0010	−0.0006	−0.0005	0.0011	0.0011
	(1.26)	(1.17)	(1.17)	(−0.46)	(−0.33)	(0.85)	(0.85)
CF	0.0037	0.0041	0.0034	0.0066	0.0024	0.0124	0.0098
	(0.57)	(0.61)	(0.52)	(0.83)	(0.29)	(1.08)	(0.82)
ROA	−0.0110	−0.0118 *	−0.0119	−0.0087	−0.0102	−0.0084	−0.0073
	(−1.55)	(−1.66)	(−1.65)	(−0.82)	(−0.97)	(−0.90)	(−0.72)
Cash	−0.0126 **	−0.0124 **	−0.0125 **	−0.0103 *	−0.0105 *	−0.0118 *	−0.0115 *
	(−2.40)	(−2.37)	(−2.40)	(−1.67)	(−1.68)	(−1.79)	(−1.86)
Age	−0.0019 *	−0.0018 *	−0.0018 *	−0.0017	−0.0018 *	−0.0042 ***	−0.0039 ***
	(−1.73)	(−1.70)	(−1.75)	(−1.65)	(−1.69)	(−2.89)	(−2.78)
Cost	−0.0292 **	−0.0286 **	−0.0286 **	−0.0334 **	−0.0308 **	−0.0181 **	−0.0125 *
	(−2.54)	(−2.49)	(−2.51)	(−2.29)	(−2.05)	(−1.94)	(−1.66)
Size	−0.0000	−0.0001	−0.0001	−0.0009	−0.0008	0.0012 *	0.0013 *
	(−0.07)	(−0.10)	(−0.11)	(−1.34)	(−1.17)	(1.87)	(1.86)
Lev	−0.0009	−0.0012	−0.0012	−0.0051	−0.0052	0.0089 *	0.0089 *
	(−0.27)	(−0.36)	(−0.36)	(−1.24)	(−1.22)	(1.75)	(1.79)
RET	−0.0002	−0.0001	−0.0002	0.0008	0.0008	−0.0028	−0.0025
	(−0.14)	(−0.09)	(−0.11)	(0.40)	(0.41)	(−1.22)	(−1.14)
TOP1	−0.0059	−0.0060	−0.0056	−0.0052	−0.0039	−0.0025	−0.0045
	(−1.19)	(−1.22)	(−1.18)	(−0.83)	(−0.67)	(−0.27)	(−0.50)
TOP2_5	−0.0070 *	−0.0069 *	−0.0068 *	−0.0026	−0.0030	−0.0176 **	−0.0209 **
	(−1.69)	(−1.75)	(−1.75)	(−0.41)	(−0.49)	(−2.31)	(−2.58)
BoardSize	0.0061 ***	0.0060 ***	0.0063 ***	0.0054 **	0.0060 **	0.0068 *	0.0038 *
	(2.74)	(2.68)	(2.78)	(2.10)	(2.35)	(1.91)	(1.66)
DUAL	0.0008	0.0006	0.0008	0.0017	0.0024	−0.0006	−0.0010
	(0.45)	(0.31)	(0.41)	(0.65)	(0.87)	(−0.34)	(−0.68)
Cons	−0.0039	−0.0036	−0.0035	0.0083	0.0074	−0.0643 ***	−0.0607 ***
	(−0.34)	(−0.32)	(−0.31)	(0.64)	(0.57)	(−3.00)	(−3.18)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1533	1533	1533	903	903	630	630
Adj R-squared	0.1646	0.1650	0.1645	0.2043	0.2006	0.5337	0.5292

Notes: We use robust standard error corrected for clustering adjustments at the firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

This provides further evidence for our theory. Directors with official backgrounds serve as supervisors in state-owned enterprises, increasing the burden of environmental policies on the enterprises. Politically connected directors in non-state-owned enterprises act as "relational resource providers", allowing for rent-seeking from the government, which in turn creates conditions for avoiding environmental regulations. Because of the difference in roles between the non-SOE and the SOE, the politically connected director in the non-SOE has a negative influence on the level of EPI.

4.2. Endogeneity Treatment: A Quasi-Natural Experiment Based on the Exogenous Policy Shock

When investigating the impact of politically connected directors on EPI, we will encounter the problem of endogeneity, as politically connected director appointments may also result from the firm's existing environmental protection investment characteristics [48].

To address this issue, an exogenous political shock is used to design a quasi-natural experiment in this paper.

In October 2013, the Organization Department of the CPC Central Committee issued the Opinions on Further Standardizing Party and Government Leaders' Holding a Part-time (Full-time) Post in Enterprises ("Regulation 18"). According to Regulation 18, officials are not permitted to hold positions in the company; those who do hold positions in the company must leave within three months. Though both the Civil Servant Law of the People's Republic of China and the Code of Ethics for Communist Party of China Cadres to Perform Official Duties Honestly (Z.F. [2010] No.3) have already prohibited government officials from engaging in any profit-making activity without authorization, the provisions of Regulation 18 are more practical. Additionally, we saw that this opinion is strictly implemented in a much stricter governance environment than ever before. As a result, we believe that the introduction of Regulation 18 is a perfect exogenous shock for us to use in establishing a DID model [38,72]. Because Regulation 18 was introduced in 2013, and not all policy effects could be seen in that year, the 2013 firm-year sample was removed when building the DID model. We designated 2009 and 2012 as the years before the political shock, setting their Post variable to 0. We designated 2014 and 2019 as the years after the political shock, setting their Post variable to 1.

We take companies that did not have official background directors at the end of 2012 before the introduction of Regulation 18 as the control group, setting their Treat variable to 0. We take companies that had official background directors at the end of 2012 before the introduction of Regulation 18 as the treatment group, setting their Treat variable to 1. Finally, we build the DID model shown below.

$$EPI = \gamma_0 + \gamma_1 Treat + \gamma_2 Post + \gamma_3 Treat \times Post + \gamma_4 ControlVars + \varepsilon$$

Figures 3 and 4 show the changes in environmental protection investments by non-SOEs and SOEs before and after the policy shock. Before the policy shock, the levels of EPI in the control group (Treat = 0) and treatment group (Treat = 1) are parallel. After the policy shock, the environmental protection investment level in state-owned enterprises falls, while the treatment group environmental protection investment level in non-state-owned enterprises rises. At the same time, we can see that the impact of political connections on corporate environmental protection investment will continue for a long time, rather than being a short-term phenomenon.
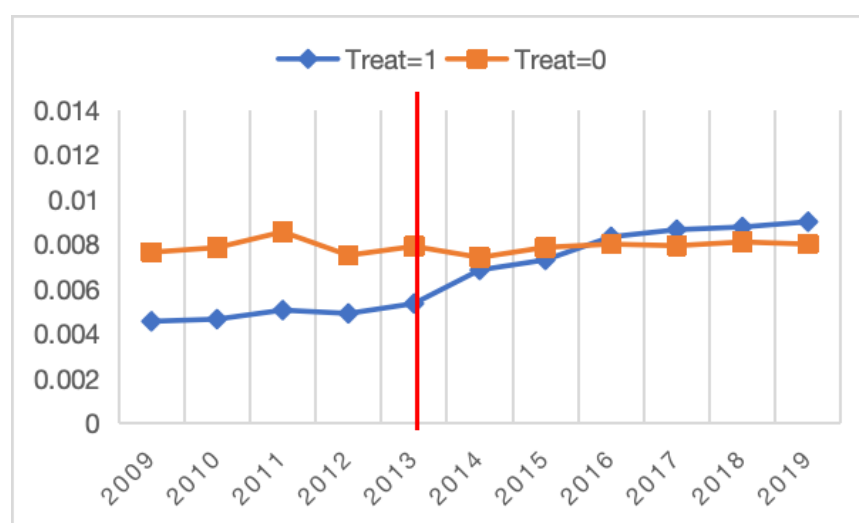
Figure 3. Non-SOE.
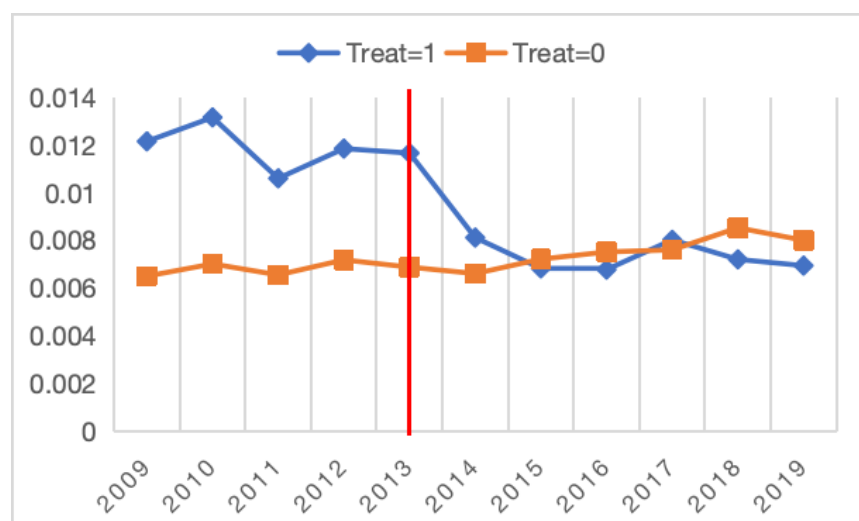
Figure 4. SOE.

Table 4 shows the regression results of the DID model. The coefficient of Treat × Post in column 2 is significantly negative at the 1% level, indicating that the introduction of Regulation 18 significantly reduces the treatment group's environmental protection investment level in SOEs. Additionally, the coefficient of Treat × Post in column 3 is significantly positive at the 1% level, indicating that the introduction of Regulation 18 significantly raises the level of environmental protection investment in the treatment group among the non-SOEs. The regression results of the DID model provide positive evidence for our theory on the causal relationship between political connection and corporate environmental protection investment.

Table 4. Regression results of the DID model.

Dependent Variable: EPI	(1) All Sample	(2) SOE	(3) Non-SOE
Treat	0.0024 *	0.0034 *	−0.0003
	(1.73)	(1.83)	(−0.15)
Post	−0.0004	−0.0024	0.0058 **
	(−0.38)	(−1.62)	(2.34)
Treat × Post	−0.0018	−0.0045 ***	0.0028 ***
	(−0.93)	(−2.98)	(2.86)
Firm_Q	0.0006	−0.0015	0.0014
	(0.62)	(−0.80)	(1.37)
CF	0.0075	0.0080	0.0089
	(0.92)	(0.83)	(0.57)
ROA	−0.0098	−0.0059	0.0034
	(−1.30)	(−0.48)	(0.30)
Cash	−0.0152 **	−0.0133 *	−0.0083 *
	(−2.43)	(−1.91)	(−185)
Age	−0.0017 *	−0.0019	−0.0043 ***
	(−1.67)	(−1.24)	(−2.87)
Cost	−0.0241 *	−0.0258 *	−0.0104
	(−1.94)	(−1.71)	(−0.58)
Size	−0.0001	−0.0011	0.0014 **
	(−0.27)	(−1.56)	(2.22)
Lev	−0.0034	−0.0085 *	0.0041
	(−0.89)	(−1.76)	(0.79)
RET	0.0002	0.0019	−0.0068 **
	(0.13)	(1.00)	(−1.99)

Table 4. *Cont.*

Dependent Variable: EPI	(1) All Sample	(2) SOE	(3) Non-SOE
TOP1	−0.0036	−0.0053	−0.0055
	(−0.74)	(−0.81)	(−0.80)
TOP2_5	−0.0059	0.0004	−0.0156 ***
	(−1.25)	(0.06)	(−2.74)
BoardSize	0.0084 ***	0.0079 **	0.0088 ***
	(2.92)	(2.39)	(2.59)
DUAL	0.0002	0.0008	−0.0017
	(0.07)	(0.24)	(−0.81)
Cons	0.0012	0.0292 *	−0.0349 **
	(0.09)	(1.66)	(−2.13)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	1403	813	590
Adj R-squared	0.1951	0.3549	0.4073

Notes: We use robust standard error corrected for clustering adjustments at firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

4.3. Robustness Check of the Baseline Results: Sample Selecting Bias

The data on corporate environmental protection investment used in this paper were gathered manually from social responsibility reports. Our research collected 1533 firm-annual samples, which is nearly one-fifth of the total number of listed companies in the pollution industry samples, resulting in a sample selection bias problem in our research. The sample selection bias issue is one of the most common problems in CSR research. To overcome the sample selection bias, we created two new environmental protection investment variables, EPI_Dummy and EPI_All. EPI_Dummy is defined as 1 if the company discloses environmental protection investment and 0 otherwise. EPI_All equals Ln (EPI × 100 + 1), where EPI is set to 0 when the company does not disclose its environmental protection investment. Because EPI Dummy is a dummy variable, we used the probit model for regression when the dependent variable was changed to EPI Dummy. Considering EPI_All is censored at 0, we used the tobit model for regression analysis when the dependent variable was replaced with EPI_All.

Table 5 shows the regression results after accounting for sample selection bias. In columns 1 to 4, the dependent variable was replaced with EPI_Dummy. In the SOE group, the coefficient of PD_Dummy is significantly positive at the 5% level. This suggests that even after considering sample selection bias, the finding that directors' official backgrounds can improve corporate environmental protection investment in SOEs remains reliable. In the non-SOE group, the coefficient of PD_Dummy and PD_Ratio is significantly negative. This supports our finding that directors' official backgrounds can decrease corporate environmental protection investment in the non-SOE group, and it remains reliable. In columns 5 to 8, the dependent variable is replaced with EPI_All. We can see that in the SOE group, the coefficients of PD_Dummy and PD_Ratio are significantly positive at the levels of 1% and 10%, respectively. This suggests that even after considering sample selection bias, the finding that directors' official backgrounds can improve corporate environmental protection investment in SOEs remains reliable. In the non-SOE group, the coefficient of PD_Dummy and PD_Ratio is negative. This supports our finding that directors' official backgrounds can decrease corporate environmental protection investment in non-SOEs.

Table 5. Regression Results: Considering Sample Selecting Bias.

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EPI_Dummy				EPI_All			
	SOE		Non−SOE		SOE		Non−SOE	
PD_Dummy	0.2185 **		−0.3602 **		0.2422 ***		−0.1263	
	(2.24)		(−1.98)		(3.52)		(−1.26)	
PD_Ratio		0.2059		−2.2962 **		0.1848 *		−1.6781 ***
		(1.49)		(−2.45)		(1.66)		(−3.30)
Firm_Q	−0.0957	−0.0834	−0.0827	−0.1035	−0.0697	−0.0625	−0.0084	−0.0193
	(−1.18)	(−1.04)	(−0.78)	(−0.99)	(−1.19)	(−1.06)	(−0.15)	(−0.35)
CF	1.5211 *	1.5009 *	0.9330	0.5786	1.1253 *	1.0297	0.5491	0.3367
	(1.71)	(1.68)	(0.64)	(0.41)	(1.79)	(1.62)	(0.69)	(0.44)
ROA	1.4333	1.5446	3.6541	4.1466 *	0.4807	0.6363	1.3128	1.5426
	(0.89)	(0.95)	(1.29)	(1.71)	(0.42)	(0.55)	(0.83)	(1.03)
Cash	−1.6316 ***	−1.7126 ***	−1.7868 **	−1.5771 *	−1.1721 ***	−1.2520 ***	−1.0136 **	−0.8800 **
	(−2.94)	(−3.06)	(−2.03)	(−1.80)	(−2.98)	(−3.10)	(−2.07)	(−1.98)
Age	0.0067	−0.0141	−0.1809 *	−0.1682	−0.0020	−0.0161	−0.1439 **	−0.1379 **
	(0.07)	(−0.15)	(−1.70)	(−1.32)	(−0.03)	(−0.24)	(−2.01)	(−2.01)
Cost	1.3686 **	1.4147**	−1.3336	−1.4743	0.8089 *	0.8700 *	−0.8654	−0.8977 *
	(1.96)	(2.02)	(−1.25)	(−1.40)	(1.66)	(1.73)	(−1.45)	(−1.76)
Size	0.2439 ***	0.2572 ***	0.6653 ***	0.6092 ***	0.1294 ***	0.1432 ***	0.3909 ***	0.3521 ***
	(4.82)	(5.08)	(4.95)	(4.69)	(3.63)	(3.96)	(5.28)	(5.07)
Lev	−1.1503 ***	−1.1355 ***	−0.5276	−0.3603	−0.6903 ***	−0.6913 ***	−0.2321	−0.1465
	(−3.19)	(−3.13)	(−0.74)	(−0.52)	(−2.73)	(−2.67)	(−0.59)	(−0.39)
RET	−0.2033	−0.1844	0.3351	0.3740	−0.1450	−0.1279	0.1486	0.1665
	(−1.19)	(−1.08)	(1.11)	(1.24)	(−1.21)	(−1.05)	(0.89)	(1.03)
TOP1	0.2548	0.2346	−0.8129	−1.0206	0.0992	0.0953	−0.5196	−0.6480 *
	(0.67)	(0.61)	(−1.21)	(−1.52)	(0.37)	(0.35)	(−1.41)	(−1.82)
TOP2_5	−0.4425	−0.4232	0.4794	0.3128	−0.3790	−0.3973	−0.0106	−0.1359
	(−0.87)	(−0.83)	(0.50)	(0.33)	(−1.05)	(−1.08)	(−0.02)	(−0.27)
BoardSize	0.3152	0.3327	−1.2463 ***	−1.3795 ***	0.3253 *	0.3451 *	−0.5651 **	−0.6460 ***
	(1.27)	(1.34)	(−2.66)	(−2.93)	(1.85)	(1.94)	(−2.18)	(−2.59)
DUAL	−1.3746 ***	−1.3879 ***	−1.1662 ***	−1.1326 ***	−0.8615 ***	−0.8809 ***	−0.6361 ***	−0.6109 ***
	(−9.96)	(−10.02)	(−5.15)	(−5.13)	(−8.97)	(−9.03)	(−5.11)	(−5.19)
Cons	−5.8490 ***	−6.0201 ***	−12.1413 ***	−10.1405 ***	−3.5210 ***	−3.7428 ***	−7.3898 ***	−6.0498 ***
	(−5.01)	(−5.15)	(−4.23)	(−3.63)	(−4.27)	(−4.48)	(−4.67)	(−4.06)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4063	4063	3213	3213	4063	4063	3213	3213
Pseudo_R2	0.3205	0.3201	0.2163	0.2167	0.3211	0.3240	0.2189	0.3205

Notes: The explanatory variables in models 1–4 are dummy variables, using the probit regression model. In models 5–8, the left constrained point of the independent variables is 0, using the Tobit regression mode; we use robust standard error corrected for clustering adjustments at firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

5. Underlying Mechanisms

5.1. Different Roles of the Politically Connected Directors: Supervisors or Resource Providers?

The composition of a board with politically connected directors is a significant aspect of the board structure, as it reflects the influence of the government on corporations. Since the board is responsible for making crucial corporate decisions, having politically connected directors implies that the government has a certain level of control over these decisions. Typically, directors with a background in state-owned enterprises tend to seek a secure retirement or opportunities for promotion. They often act as representatives of the government, actively working towards fulfilling policy requirements and assisting local governments in meeting their performance targets. Recently, when the central government lists the improvement of ecological civilization in the government evaluation system,

politically connected directors in state-owned enterprises are motivated to increase their investment in environmental protection.

State-owned enterprises tend to appoint more government officials with political connections rather than professionals on their boards of directors, which negatively affects corporate governance [73]. This increase in the proportion of politically connected directors tends to result in urging state-owned enterprises to invest more in environmental protection. Conversely, non-state-owned enterprises are willing to pay high salaries to politically connected directors in the hopes of securing political benefits like tax breaks, government subsidies, and administrative permits for regulated industries. Therefore, politically connected directors in non-state-owned enterprises often act as "relational resource providers". These two types of politically connected directors perform their duties differently. Politically connected directors in state-owned enterprises are more concerned with future promotions, whereas politically connected directors in non-state-owned enterprises prioritize their current salaries.

Our investigation into the mechanism involves two channels: politically connected directors' motivation for promotion and officials' motivation for salaries. To clarify, we divide politically connected directors into retired and current officers, as current officers are more motivated for career promotion. We predict a stronger positive relationship between current officials and corporate environmental protection investments in SOEs compared to retired officials. We believe that private companies will pay higher salaries to politically connected directors. The salaries paid to politically connected directors in non-state-owned enterprises can be considered as a cost for the relationship resource that can help them avoid environmental regulation.

Table 6 displays the regression outcome. Columns 1 and 3 display the regression results of the mechanism of politically connected directors' motivation for promotion. If the politically connected director is still in a government office, we set the Current variable to 1; otherwise, we set the Current variable to 0. The regression results show that the coefficient of the Current in the SOE group is 0.0033 and statistically significant at the 5% level. This suggests that in SOEs, the motivation for the promotion of politically connected directors may result in increased corporate environmental protection investments. However, in the group of non-SOEs, the coefficient of Current is not significant, and this insignificant outcome could be due to a combination of factors. On the one hand, officials in government offices are motivated to increase corporate environmental protection investment to gain more promotion opportunities for their future political careers, while on the other hand, officials in the offices have an easier time reducing corporate environmental protection investment through rent-seeking behavior by using their current power.

Columns 2 and 4 display the regression results of the investigation into the mechanism of politically connected directors' motivation for salaries. Variable LnPay represents a director's monetary salary, which is equal to the natural logarithm of the director's monetary salary. The regression results show that the coefficient of LnPay is not significant in the grouping of state-owned enterprises, while in the grouping of non-SOEs, the coefficient of LnPay is −0.0016 and significant at the 1% level. This implies that as politically connected director compensation increases, the level of corporate environmental protection investment decreases significantly in non-SOEs. These regression results support our hypothesis that the politically connected director in SOEs and non-SOEs play different roles. Politically connected directors serve as "deputies representing the government will" in SOEs, acting more like government supervisors. In non-SOEs, politically connected directors serve as "relation resource providers".

Table 6. The underlying mechanism of the impact of political connections on the EPI.

Dependent Variable: EPI	(1)	(2)	(3)	(4)
	SOE		Non−SOE	
Current	0.0033 **		0.0032	
	(2.41)		(1.53)	
LnPay		0.0002		−0.0016 ***
		(1.19)		(−2.81)
Firm_Q	−0.0005	−0.0002	−0.0009	−0.0009
	(−0.30)	(−0.09)	(−0.65)	(−0.53)
CF	0.0023	0.0042	0.0163	0.0126
	(0.21)	(0.39)	(1.04)	(0.79)
ROA	−0.0134	−0.0144	−0.0046	−0.0006
	(−0.87)	(−0.94)	(−0.44)	(−0.05)
Cash	−0.0128 *	−0.0132 *	−0.0085	−0.0107 *
	(−1.79)	(−1.90)	(−1.61)	(−1.69)
Age	−0.0027	−0.0030	−0.0031 *	−0.0034 **
	(−1.36)	(−1.55)	(−1.87)	(−2.07)
Cost	−0.0194	−0.0219	−0.0118	−0.0034
	(−0.90)	(−1.03)	(−0.52)	(−0.17)
Size	−0.0006	−0.0004	−0.0005	0.0003
	(−0.68)	(−0.45)	(−0.46)	(0.21)
Lev	−0.0107 *	−0.0124 **	0.0024	0.0004
	(−1.88)	(−2.19)	(0.50)	(0.07)
RET	0.0032	0.0021	−0.0046 *	−0.0043 *
	(0.85)	(0.55)	(−1.87)	(−1.66)
TOP1	−0.0137 *	−0.0143 *	0.0063	0.0041
	(−1.71)	(−1.69)	(0.58)	(0.37)
TOP2_5	−0.0099	−0.0093	−0.0041	−0.0060
	(−1.24)	(−1.15)	(−0.35)	(−0.54)
BoardSize	0.0054 *	0.0056 *	0.0040	0.0021
	(1.72)	(1.77)	(0.79)	(0.45)
DUAL	0.0006	0.0006	−0.0023	−0.0026
	(0.22)	(0.22)	(−0.98)	(−1.11)
Cons	0.0335	0.0319	0.0125	0.0041
	(1.66)	(1.57)	(0.59)	(0.17)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	903	903	630	630
Adj R-squared	0.2631	0.2642	0.5987	0.5916

Notes: We use robust standard error corrected for clustering adjustments at the firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

5.2. Further Consideration of the Politically Connected Director's Individual Characteristics

The Ministry of Environmental Protection, which was established in 2008 under the direction of the State Council, is the highest administrative authority in the field of environmental protection. In practice, however, the subordinate agencies of the Ministry of Environmental Protection are generally at a lower administrative level and are easily intervened by local governmental agencies at the same or a higher level. Under pressure from higher-ranking officials, it is difficult for officials in charge of environmental supervision to maintain their independence. As a result, the higher the administration level of politically connected directors, the more likely the enterprises are to obtain high-quality relational resources, intervene in the law enforcement of environmental regulating authorities, and ultimately achieve the goal of reducing environmental protection investments. In addition, according to the correlation between directors and corporate benefits, board members can be divided into affiliated directors and independent directors. This is another demonstration of board structure. In a company, affiliated directors and independent directors have different decision-making powers.

Independent directors frequently lack a thorough understanding of corporate operations because they are not involved in the business operations of the companies [74]. As a result, the independent directors can be isolated from other affiliated directors who can provide more practical suggestions for the company. Their opinion can easily be ignored by other board members, and because the right to choose independent directors is largely determined by the other affiliated directors, many independent directors are unwilling to challenge the decisions made by the other directors. In fact, their votes can be influenced by the other directors, making them puppets, but it is not an effective way to influence enterprise decisions. It is obvious that affiliated directors with political connections have a greater influence on corporate environmental protection investment than independent directors with political connections.

To measure the politically connected directors' individual characters, we introduce two independent variables: politically connected directors' administration level (PD_PL) and whether he/she is an independent director (PD_DEP).

a.   Administration level of politically connected director (PD_PL)

According to Chinese government documents, there are four major administration levels in the Chinese government: national, province, city, and county. By dividing each administration level into two sublevels (leader and assistant), we can classify the administration level of Chinese officials into eight levels. In our study, we assign a score from 1 to 8 to each administration level, with 1 to the lowest administrative level and 8 to the highest.

b.   Whether the politically connected director is an independent director (PD_DEP)

When a politically connected director is an independent director, the PD_DEP value is 1; otherwise, it is 0.

Table 7 displays the regression results when the individual characters of the politically connected directors are considered. As variables representing the individual characters of the politically connected directors, the variables PD_DEP and PD_PL are used as dependent variables in the regression analysis. Columns 1 and 2 show the regression results in the all-sample group. The coefficients of PD_DEP and PD_PL are both positive but not statistically significant. Columns 3 to 6 show the regression results in the state-owned enterprises and non-state-owned enterprises. We can see that the PD_DEP is significantly positive in column 3, but the PD_DEP is not significant in column 5. This implies that when politically connected directors are affiliated directors, they have a greater influence on the behavior of state-owned enterprises. As a result, when politically connected directors are affiliated directors, state-owned enterprises are more likely to improve their EPI. The coefficient of PD_PL in column 6 is negative at a significant level of 1%. This indicates the higher the administrative level of the politically connected directors, the lower the level of the EPI in non-state-owned enterprises. The higher-rank politically connected directors can provide better relational resources that can help the enterprises better avoid environmental regulations.

These regression results back up our theory. Furthermore, the coefficient of PD_PL in column 4 is positive at a significance level of 10%. This indicates that when the administrative level of politically connected directors is higher, the EPI level also rises in state-owned enterprises. We believe that this is because the politically connected directors with a higher administrative level can have a deeper influence on the other members of the board. When the politically connected directors encourage the state-owned enterprises to invest more in the environmental protection field, other directors may follow their calls, which means that the politically connected directors can perform as well as the supervisors from the government.

Table 7. Further consideration of individual characters of the politically connected directors.

Dependent Variable: EPI	(1) All Sample (with Politically Connected Directors)	(2) All Sample (with Politically Connected Directors)	(3) SOE (With Politically Connected Directors)	(4) SOE (With Politically Connected Directors)	(5) Non−SOE (with Politically Connected Directors)	(6) Non−SOE (with Politically Connected Directors)
PD_DEP	0.0031		0.0041 **		0.0010	
	(1.15)		(2.18)		(0.89)	
PD_PL		0.0005		0.0011 *		−0.0019 ***
		(0.94)		(1.69)		(−3.15)
Firm_Q	0.0006	0.0006	−0.0001	−0.0007	−0.0006	−0.0022 *
	(0.62)	(0.55)	(−0.06)	(−0.41)	(−0.42)	(−1.70)
CF	0.0040	0.0052	0.0048	0.0038	0.0104	0.0045
	(0.42)	(0.56)	(0.44)	(0.35)	(0.70)	(0.30)
ROA	−0.0108	−0.0106	−0.0165	−0.0085	0.0035	0.0047
	(−1.08)	(−1.07)	(−1.14)	(−0.58)	(0.29)	(0.45)
Cash	−0.0138 *	−0.0145 **	−0.0147 **	−0.0124 *	−0.0083	−0.0157 **
	(−1.94)	(−2.00)	(−2.02)	(−1.85)	(−0.86)	(−1.98)
Age	−0.0026 *	−0.0024 *	−0.0030*	−0.0025	−0.0025 *	−0.0024 **
	(−1.74)	(−1.70)	(−1.67)	(−1.31)	(−1.74)	(−1.97)
Cost	−0.0121	−0.0208	−0.0144	−0.0294	−0.0020	0.0155
	(−0.67)	(−1.11)	(−0.64)	(−1.34)	(−0.09)	(0.77)
Size	−0.0001	−0.0004	−0.0004	−0.0009	0.0001	0.0015 *
	(−0.13)	(−0.57)	(−0.46)	(−1.14)	(0.12)	(1.69)
Lev	−0.0037	−0.0054	−0.0112 *	−0.0127 **	0.0032	−0.0017
	(−0.83)	(−1.27)	(−1.87)	(−2.22)	(0.65)	(−0.46)
RET	−0.0017	−0.0012	0.0021	0.0031	−0.0051 **	−0.0045 **
	(−0.64)	(−0.48)	(0.54)	(0.83)	(−1.82)	(−1.86)
TOP1	−0.0045	−0.0052	−0.0134 *	−0.0139 *	0.0046	0.0057
	(−0.56)	(−0.70)	(−1.71)	(−1.75)	(0.41)	(0.59)
TOP2_5	−0.0086	−0.0080	−0.0116 *	−0.0127 *	−0.0077	−0.0130
	(−1.32)	(−1.17)	(−1.69)	(−1.71)	(−0.74)	(−1.28)
BoardSize	0.0055 *	0.0061 **	0.0059 *	0.0070*	0.0017	0.0013
	(1.86)	(1.96)	(1.75)	(1.68)	(0.45)	(0.38)
DUAL	0.0000	0.0002	0.0005	0.0009	−0.0019	−0.0004
	(0.02)	(0.07)	(0.18)	(0.30)	(−0.90)	(−0.25)
Cons	0.0078	0.0108	0.0316	0.0373 *	0.0053	−0.0135
	(0.52)	(0.73)	(1.54)	(1.91)	(0.21)	(−0.63)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	915	915	510	510	405	405
Adj R-squared	0.1800	0.1852	0.2331	0.2337	0.4529	0.4556

Notes: We use robust standard error corrected for clustering adjustments at the firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

5.3. The Moderating Effect of Regional Environmental Regulatory Intensity

Local environmental regulatory intensity has a moderating effect on the relationship between political connections and enterprise investment in environmental protection [75]. When the local government imposes stricter local environmental regulatory intensity on enterprises, the enterprises' environmental protection costs rise [76,77]. For non-state-owned enterprises, there will be a stronger incentive to hire politically connected directors to avoid environmental regulations. For state-owned enterprises, the politically connected directors, as the "deputies representing the government will", will push the enterprise to a higher level of environmental protection investment. Stricter environmental regulations reveal the local government's determination to improve environmental protection. To demonstrate that they are a supporter of the local government, politically connected directors in state-owned enterprises tend to increase environmental protection investment to assist the local government in meeting their environmental protection targets.

To investigate the moderating effect of local environmental regulatory intensity, we introduce a new comprehensive variable, REG, representing the level of local environmental regulatory intensity. The REG is calculated from the index of compliance rate of industrial wastewater emission, the compliance rate of industrial waste gas emission, and the industrial solid waste utilization rate. The calculation method for the REG is shown as follows:

First, we calculate the standardized compliance rate for all types of pollutant emissions.

$$Emission_{i,j} = \frac{X_{i,j} - min(X_i)}{max(X_j) - min(X_j)} \qquad (2)$$

$X_{i,j}$ represents the emission compliance rate of pollutant j in i province, while min (X_j) and max (X_j) represent the minimum and maximum values of the pollutant j. The above formula concludes the standardized value of the emission compliance rate of pollutant j in i province. The weight of each pollutant emission is then calculated.

$$Weight_{i,j} = \frac{T_{i,j}/P_i}{\sum\limits_{i} T_{i,j}/\sum\limits_{i} P_i} \qquad (3)$$

$T_{i,j}$ represents the pollutant j in i province, P_i represents the industrial value added in province i. The weight shows the ratio of pollutant j emissions caused by a unit of output value in a province to national pollutant j emissions per unit of output value. Finally, using the following equation, we can obtain the final result of the variable REG.

$$REG_i = \sum\limits_{j} (Emissioin_{i,j} \times Weight_{i,j}) \qquad (4)$$

REG represents the province's degree of environmental control; the higher the value, the greater the degree of environmental control. The data of pollutant emission compliance rate and industrial added value required for environmental control indicators are obtained from the China Statistical Yearbook on Environment and the China Statistical Yearbook, in which the data of Tibet are missing, so the sample of this region is excluded. The regression model is as follows:

$$EPI_{i,t} = \alpha_0 + \alpha_1 PD_{i,t-1} + \alpha_2 REG_{i,t-1} + \alpha_3 PD_{i,t-1} \times REG_{i,t-1} + \sum\limits_{f} \alpha_f ControlVars_{i,t-1} + \mu$$

$$(5)$$

where, i, t, and ε refer to company, year, and residual term, respectively. Considering heteroscedasticity and the sequence of panel data, this paper makes cluster adjustments for standard errors at the firm level. Year and industry fixed effects have also been controlled for.

Table 8 shows the regression results of the moderating effect on the relationship between political connections and enterprise investment in environmental protection. In columns 1 and 2, we can see that the coefficients of PD_Dummy × REG and PD_Ratio × REG are significantly positive in the state-owned enterprises. This indicates that local environmental regulatory intensity has a positive influence on the impact of political connections on environment protection investment in state-owned enterprises. In columns 3 and 4, the coefficients of PD_Dummy × REG and PD_Ratio × REG are negative at a significance level of 1% in the non-state-owned enterprises. This indicates that the higher level of local environmental regulatory intensity will strengthen the negative impact of political connections on environment protection investment in non-state-owned enterprises. These regression results provide us with further evidence for our research.

Table 8. The moderating effect of regional environmental regulations.

Dependent Variable: EPI	(1)	(2)	(3)	(4)
	SOE		Non − SOE	
PD_Dummy	0.0016 *		−0.0003	
	(1.67)		(−1.21)	
PD_Ratio		0.0041		−0.0031
		(1.59)		(−1.15)
REG	0.0008	0.0005	0.0004	0.0003
	(0.48)	(0.32)	(1.26)	(0.54)
PD_Dummy × REG	0.0009 **		−0.0004 ***	
	(2.14)		(−2.63)	
PD_Ratio × REG		0.0015 ***		−0.0021 ***
		(3.12)		(−3.63)
Firm_Q	−0.0007	−0.0003	0.0006	0.0005
	(−0.52)	(−0.25)	(0.43)	(0.39)
CF	0.0074	0.0047	0.0150 *	0.0120
	(0.93)	(0.56)	(1.69)	(1.43)
ROA	−0.0097	−0.0120	−0.0092	−0.0099
	(−0.92)	(−1.13)	(−0.92)	(−0.92)
Cash	−0.0096 *	−0.0099 *	−0.0116 *	−0.0095
	(−1.84)	(−1.89)	(−1.70)	(−1.65)
Age	−0.0013	−0.0017	−0.0044 ***	−0.0039 ***
	(−0.96)	(−1.29)	(−3.04)	(−2.66)
Cost	−0.0352 ***	−0.0299 **	−0.0159	−0.0079
	(−2.65)	(−1.97)	(−0.83)	(−0.40)
Size	−0.0010 *	−0.0007	0.0016 *	0.0019 *
	(−1.75)	(−1.08)	(1.66)	(1.71)
Lev	−0.0055	−0.0049	0.0092 *	0.0101 **
	(−1.36)	(−1.09)	(1.68)	(1.98)
RET	0.0007	0.0009	−0.0022	−0.0019
	(0.36)	(0.44)	(−0.94)	(−0.84)
TOP1	−0.0027	−0.0026	−0.0040	−0.0076
	(−0.49)	(−0.47)	(−0.43)	(−0.84)
TOP2_5	−0.0003	−0.0027	−0.0179 **	−0.0201 ***
	(−0.06)	(−0.44)	(−2.22)	(−2.66)
BoardSize	0.0051 **	0.0057 **	0.0057*	0.0028
	(2.09)	(2.38)	(1.76)	(0.92)
DUAL	0.0021	0.0027	−0.0007	−0.0008
	(0.78)	(1.00)	(−0.40)	(−0.50)
Cons	0.0201	0.0177	−0.0244	−0.0236
	(1.33)	(1.07)	(−1.25)	(−1.03)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	903	903	630	630
Adj R−squared	0.2245	0.2321	0.3649	0.3981

Notes: We use robust standard error corrected for clustering adjustments at the firm level [71]. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

6. Conclusions

This paper aims to investigate the impact of political connections on environmental protection investment behavior of listed companies in pollution-intensive industries in China. We analyze the causal effect of political connections on environmental protection investment behavior from the perspective of ownership difference. To overcome endogeneity in our research, we use Regulation 18 as an exogenous shock and examine its influence on corporate environmental protection investment behavior.

Our study highlights several important findings regarding the relationship between corporate ownership structure, politically connected directors, and environmental protection investment. Specifically, state-owned enterprises tend to have a higher level of environmental protection investment compared to non-state-owned enterprises. In state-

owned enterprises, politically connected directors, especially affiliated directors, have a positive impact on the level of corporate environmental protection investment. However, in non-state-owned enterprises, the presence of politically connected directors reduces environmental protection investment, with investment levels declining further as the administration level of the politically connected director rises. Furthermore, the impact of local regulation appears to strengthen the relationship between political connections and environmental protection investment. Specifically, Regulation 18 has a positive impact on environmental protection investment in private corporations but leads to a decrease in investment for state-owned corporations. Overall, these findings suggest that the composition of a company's board of directors is a critical factor that influences its decision to invest in environmental protection. Policymakers should consider the impact of corporate characteristics, such as ownership structure and political connections, on environmental protection investment behavior when designing and implementing environmental regulations and incentives.

Based on the different roles exhibited by politically connected directors in companies with varying ownership structures, we offer the following suggestions: Regarding non-state-owned companies, the presence of politically connected directors may offer the company access to political resources and protection, which can be detrimental to investments in environmental protection. In addition, the non-state-owned companies that utilize their political connections create an unjust market environment by obtaining exclusive access to government officials. This grants them favorable treatment, contracts, and regulatory benefits, thereby creating an unequal playing field. As a result, not only does this distortion of competition occur, it also undermines the fundamental principles of fairness and equal opportunity. Therefore, we recommend that policymakers consider implementing measures to minimize political connections within non-state-owned companies. In contrast, in state-owned companies, politically connected directors assume a supervisory role on behalf of the government. Their presence can facilitate effective monitoring of the company's environmental protection practices by regulatory authorities. While involving politically connected directors may assist policymakers in better supervising state-owned companies, this measure could also have negative implications for company behavior. For instance, it may lead to a decrease in operational efficiency and an increase in rent-seeking behaviors. To address this concern, we recommend that policymakers additionally contemplate implementing measures to guarantee transparency and accountability in the appointment of politically connected directors within state-owned companies. Such measures would help prevent potential abuses of power and conflicts of interest.

Our study is subject to several limitations: (1) In our research, our primary focus is on the Chinese context. While China is one of the largest developing countries, it is important to acknowledge that the research findings may not be directly applicable to other countries, particularly developed nations. (2) Moreover, we are facing limitations in using up-to-date data from the most recent period. Due to the unprecedented impact of the COVID-19 epidemic, Chinese companies experienced a unique and challenging period from 2019 to 2023. During this time, their behavior and operations significantly diverged from their pre-epidemic norms. Consequently, in our research, we have chosen not to utilize data from this period, as it may not accurately reflect the typical behaviors and conditions of the companies in question. Combined with the limitations of this study, we believe one of the key areas of future research is comparing and analyzing the influence of political connections on green innovation in different economic environments and further verifying the influencing mechanism of political connections on enterprise green innovation in different economic environments.

We posit that the role of a politically connected director differs significantly depending on whether they serve in a state-owned or non-state-owned enterprise. In a state-owned enterprise, a politically connected director is more akin to a government-appointed regulator, while in a non-state-owned enterprise, a politically connected director is more

similar to a high-paid resource supplier hired by the enterprise's owner. These two types of politically connected directors operate in completely different ways, with those in state-owned enterprises prioritizing future promotions and those in non-state-owned enterprises prioritizing current salaries. To encourage effective environmental regulation and return corporate environmental protection investment behavior to market-driven decisions, policymakers should be concerned about the different roles of political connections in firms' environmental protection investment based on ownership. Using the sample of China, our findings could contribute to the literature on environmental sustainability and economic development in emerging markets.

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