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**Article**

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# Multiple large shareholders and corporate environmental protection investment: Evidence from the Chinese listed companies

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## ABSTRACT

Agencies can reduce problems by adopting a governance structure of multiple large shareholders. However, multiple large shareholders may collude, thereby reducing the behavior that can create long-term value for the company. This paper uses a sample of companies listed on the Shenzhen and Shanghai stock exchanges between 2008 and 2017 to investigate the relationship between multiple large shareholders and corporate environmental protection investment (CEPI). We find that multiple large shareholders will significantly reduce CEPI. Specifically, external supervision and a company's ownership structure affect the relationship between multiple large shareholders and CEPI. In addition, after participating in SOEs, non-state-owned shareholders will significantly improve CEPI of SOEs.

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## 1. Introduction

Since the reform and opening up, the Chinese economy has achieved remarkable results, while ecological and environmental issues have become increasingly serious. According to the *2018 Global Environmental Performance Index* jointly issued by Yale University, Columbia University, and the World Economic Forum, China's environmental performance ranks 120th out of 180 economies. In terms of air quality, China ranks fourth to last based on PM<sub>2.5</sub> comprehensive evaluations. Environmental pollution causes a loss of 3.5–8% to GDP each year (Chiu and Wu, 2010). According to the Chinese Environmental Protection Department, more than 80% of pollution is caused by the production and operation of enterprises (Wei et al., 2017). Enterprises

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should actively fulfill their social responsibility to pollution prevention and control and carry out environmental governance because they continuously request and benefit from environmental resources and benefits that allow them to increase production and operation activities, which inevitably causes more pollution. To this end, Shenzhen and Shanghai stock exchanges issued *Guidelines for Social Responsibility of Listed Companies* (2006) and *Guidelines for Environmental Information Disclosure of Listed Companies* (2008), stating that listed companies should disclose their fulfillment of social and environmental responsibilities.

As a financial disclosure in a corporate social responsibility (CSR) report, corporate environmental protection investment (CEPI) pertains to enterprises that use part of an investment fund for pollution prevention and control, which belongs to both corporate governance and capital investment. By actively undertaking CEPI and fulfilling CSR, a firm may reap many benefits, including a good reputation (Aguilera-Caracuel and Guerrero-Villegas, 2017), an increase in market value (Kong et al., 2012), and improve investment efficiency (Benlemlih and Bitar, 2016). The benefits enhance the firm's long-term value. However, CEPI is a special investment that combines social, economic, and environmental benefits. It has the characteristics of a long investment cycle and low economic benefits, which restrict investment in other productive and economic projects. Most firms often do not actively carry out environmental governance and CEPI because CEPI has a high opportunity cost. A firm's main motivation to adopt a positive environmental protection investment strategy is to cope with institutional pressure (Verbeke and Rugman, 1998). Due to weak insufficient incentives, listed companies generally have insufficient environment governance, making CEPI a "passive" behavior (Maxwell and Decker, 2006).

An increasing number of scholars have investigated the external and internal factors affecting CEPI, finding that external factors include environmental regulation (Taylor et al., 2005; Maxwell and Decker, 2006; Olson, 1999), external pressure (Testa et al., 2015; Sarkar, 2008), and market competition (Ducassy and Montandru, 2015; Sengupta, 2015; Luken et al., 2008), and that internal factors include corporate culture (Sugita and Takahashi, 2013) and board structure (Jiang and Akbar, 2018; Uwuigbe and Ajibolade, 2013; Wei et al., 2017). However, there is limited evidence on the influence of ownership structure on CEPI.

Based on these findings, we select companies listed on the Shenzhen and Shanghai stock exchanges between 2008 and 2017 as the samples to examine the influence of multiple large shareholders on CEPI. We find that the CEPI of enterprises with multiple large shareholders is lower than enterprises with a single large shareholder. However, our conclusion may encounter endogeneity problems regarding missing variables and sample selection bias because the research on the relationship between ownership structure and CEPI is vulnerable to unobservable factors. Therefore, this paper adopts a fixed effect model, PSM model, DID model, and Heckman two-stage model to address potential endogeneity problems. The results show that the above conclusion is still valid after controlling potential endogeneity problems.

In addition, this paper investigates the influence of external supervision on the relationship between multiple large shareholders and CEPI. We apply marketization and examine whether a firm is audited by a Big Four accounting firm to measure the influence of external supervision on firms. We find that in regions with weak marketization and in firms not audited by a Big Four firm, the negative influence of multiple large shareholders on CEPI is more significant.

Finally, we examine the impact of heterogeneous ownership participation on CEPI. We find that the participation of non-state-owned shareholders significantly increases CEPI of SOEs. However, the participation of state-owned shareholders has no significant influence on the CEPI of non-SOEs.

The main contributions of this paper are as follows. First, this paper provides new evidence for the relationship between ownership structure and CEPI, enriching the academic literature in the field of corporate environmental management. So far, most research on corporate governance and corporate environment has focused on environmental information disclosure (Lewis et al., 2014). Research on factors affecting CEPI has focused on the institutional level (Maxwell and Decker, 2006; Verbeke and Rugman, 1998). Although there have been studies focusing on the influence of ownership structure on CSR (Faller and Zu, 2018; Félix and Óscar, 2011), the literature has not discussed the influence of ownership structure on CEPI. Therefore, this paper studies the influence of multiple large shareholders on CEPI from the perspective of corporate governance. Second, this paper enriches the research on the reform of China's mixed ownership structure. Since the Third Plenary Session of the 18th CPC Central Committee, mixed ownership reform has quickly become one of the central issues in the field of corporate governance in China. Many scholars believe that

a mixed ownership structure can improve corporate governance mechanisms to enhance corporate performance (Megginson et al., 1994; Bortolotti et al., 2002). However, the existing literature has mainly focused on its economic benefits and ignored its social benefits. Therefore, from the perspective of cross-shareholding between state-owned and non-state-owned shareholders, we discuss the influence of heterogeneous shareholding on CEPI. We find that the CEPI of SOEs will be significantly improved after non-state-owned shareholders participate in SOEs, which provides evidence to support the mixed ownership reform of SOEs in China.

Finally, this paper enriches the literature on the relevant fields of ownership structure. From the perspective of equity checks and balances, previous studies have found that multiple large shareholders can effectively monitor the behavior of the controlling shareholders to obtain private benefits (Pagano and Röell, 1998; Shleifer and Vishny, 1997). However, there is no straightforward equivalence between multiple large shareholders and equity checks and balances. Multiple large shareholder structures are highly complex. Large shareholders may have a supervisory or collusion effect on CEPI. After accounting for persons acting in concert to reorganize data on the ownership structure, as well as China's institutional background, we define large shareholders as shareholders with a shareholding ratio of no less than 10%. We then investigate the influence of multiple large shareholders on CEPI.

The structure of the rest of this paper is as follows. The second part presents the theoretical analysis and research hypothesis, the third part presents the research design, the fourth part describes the empirical test, the fifth part presents further analysis, and the sixth part offers research conclusions and policy suggestions.

## 2. Theoretical analysis and hypothesis

Principal-agent theory states that the separation of ownership and management is an important feature of modern firms. Such separation will improve firm efficiency but exacerbate conflict between shareholders and management (Jensen and Meckling, 1976). When a firm has many and widely dispersed shareholders, corporate resources may be used to meet the interests of managers rather than to maximize shareholder value. However, in countries with emerging capital markets, such as China, the ownership structure of listed companies tends to have a high concentration of ownership due to the country's economic transformation. Large shareholders have sufficient motivation and ability to supervise management (La Porta et al., 1999). Issues with corporate governance are more likely to manifest when controlling shareholders infringe on the interests of creditors and minority shareholders (Shleifer and Vishny, 1997). The conflict of interest between controlling and minority shareholders may affect a firm's investment decisions because the controlling shareholders can forgo profitable projects to preserve private benefits (Jiang et al., 2018).

CEPI is unlike other economic projects. It is not only more difficult to create direct economic inflows, but it also requires firms to spend a great deal of money on environmental protection facilities and innovative environmentally friendly technology. As corporate funds are limited, when investing a portion of funds in environmental protection, other production-oriented investments will inevitably be affected (Gray and Shadbegian, 2003), which will lead to a decline in corporate profitability. If a company only has one controlling shareholder, the controlling shareholder has a strong incentive to encroach on the interests of minority shareholders due to a lack of supervision and checks and balances from other large shareholders (Shleifer and Vishny, 1997). A controlling shareholder is more willing to invest funds in capital and physical investments that can increase their control power or change the direction of environmental protection investment toward private benefits not shared with minority shareholders (Tang and Li, 2013). For example, Tang and Li (2013) find that the shareholding ratio of the firm's largest shareholder has a negative correlation with CEPI. Therefore, if a company only has a single large shareholder, this shareholder may not have sufficient incentive to invest in CEPI.

To resolve the conflict of interest between the large shareholder and minority shareholders, many scholars have suggested that the governance structure of multiple large shareholders can reduce the behavior of controlling shareholders that infringes on the interests of minority shareholders (Cronqvist and Nilsson, 2003). Studies have shown that other large shareholders can effectively reduce the chance that controlling shareholders will attempt to obtain private income. Shareholders can reduce the behavior by reducing related transactions and capital occupation (Attig et al., 2009; Maury and Pajuste, 2005), enhancing earnings informativeness

(Boubaker and Sami, 2011), increasing the value of cash holdings (Attig et al. 2013), and improving investment efficiency (Jiang et al., 2018). Therefore, under the ownership structure of multiple large shareholders, large non-controlling shareholders can effectively monitor controlling shareholders and alleviate agency problems. Multiple large shareholders will then restrain controlling shareholders from reducing corporate environmental investment.

However, the governance structure of multiple large shareholders may also have high costs. It may be more profitable for large shareholders to collude and extract private rents that maximize their personal wealth at the expense of other shareholders. When a firm's large shareholders collude, its value decreases (Cai et al., 2015). Previous studies have shown that multiple large shareholders are more likely to collude to reduce company value (Laeven and Levine, 2008). Kahn and Winton (1998) argue that large shareholders are more inclined to collude to use private information to conduct transactions for profit rather than supervision. Cheng et al. (2013) show that it is easier for large shareholders to collude to infringe on the interests of minority shareholders when there is a relationship between multiple large shareholders. We argue that multiple large shareholders will collude to reduce CEPI. Based on theoretical predictions and mixed empirical evidence on the governance role of multiple large shareholders, the impact of multiple large shareholders on CEPI remains an empirical question. Hence, we develop the following competing hypotheses:

**Monitoring Hypothesis:** Compared with firms with a single large shareholder, firms with multiple large shareholders have higher CEPI.

**Collusion Hypothesis:** Compared with firms with a single large shareholder, firms with multiple large shareholders have lower CEPI.

### 3. Data and sample statistics

#### 3.1. Data sources and sample selection

A certain percentage of shareholders of listed companies in China hold joint shares through property association, kinship association, position association, or an “agreement of persons acting in concert.” (Hao and Gong, 2017). They act in concert when voting to protect their rights and interests. In this paper, we consider shareholders that act in concert through kinship or holding associations as single shareholders. We use data from China Securities Market and Accounting Research (CSMAR) and the CCER economic and financial database to determine joint shareholders. Take Tianjian Group Co., Ltd as an example (Fig. 1). At the end of 2014, Tianjian Group Co., Ltd had two large shareholders with shareholding ratios of more than 10%: Shenzhen Yuanzhi Investment Company (16.10%) and Shenzhen State-owned Assets Management Committee (23.47%). In theory, Tianjian Group Co., Ltd has multiple large shareholders. However, Shenzhen Yuanzhi Investment Company is controlled by the Shenzhen State-owned Assets Management Commission,

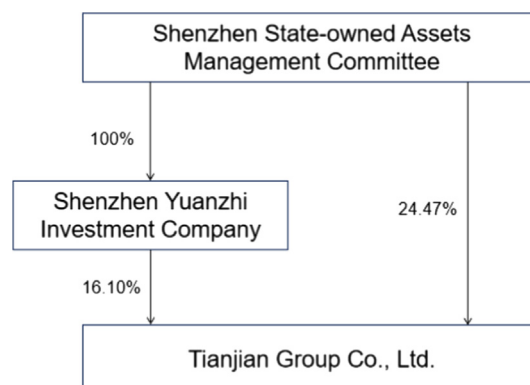


Fig. 1. The ownership control chart of Tianjian Group Co., Ltd.

so we merged the shares of these two shareholders and treated them as one shareholder. Therefore, Tianjian Group Co., Ltd does not have multiple large shareholders.

This paper's data sources are as follows. First, financial data and board structure data are from China Securities Market and Accounting Research (CSMAR) and the CCER economic and financial database. Some missing data are obtained from the annual reports of listed companies. Second, CEPI data are manually collected from independent social responsibility reports, sustainable development reports, and environmental reports disclosed by listed companies on the official website of the CSRC, CNINFO. Third, regional economic development level, regional pollution discharge level, and regional environmental regulation intensity are derived from the 2009–2018 *China Statistical Yearbooks*.

This paper takes listed companies in Shenzhen and Shanghai stock exchanges between 2008 and 2017 as the sample and selects them according to the following criteria. First, we exclude financial, insurance, and securities listed companies that have special industry attributes and operating characteristics. Second, we exclude samples with special treatment, such as ST (the company has suffered losses for two consecutive years), SST (the company has suffered losses for two consecutive years and has not completed the share reform), and \*ST (the company has suffered losses for three consecutive years) firms. Third, we exclude samples without disclosed CEPI data and samples with missing financial data and board data. Fourth, we exclude samples with every shareholder having <10% of shares. In the end, we obtain 1140 observations from 216 sample companies in 2008–2017. After Shenzhen and Shanghai stock exchanges issued *Guidelines for Environmental Information Disclosure of Listed Companies* in 2008, listed companies gradually started to disclose relevant environmental information, so we select 2008 as the starting point.

### 3.2. Variable design and definition

#### 3.2.1. Dependent variable: Corporate environmental protection investment

Referring to Jiang and Akbar (2018) and Wei et al. (2017), and considering the actual CSR report disclosure, we divide CEPI into the following six categories: (1) expenditure on environmental technology R&D and renovation, (2) expenditure on environmental protection facilities and system investment and transformation, (3) expenditure on pollution abatement, (4) expenditure on clean production, (5) expenditure on ecological protection, and (6) other corporate environment protection investment. We collect corporate environment protection investment data in strict accordance with these categories. We divide environmental protection investment by operating income to measure CEPI.

#### 3.2.2. Independent variable: Multiple large shareholders

Laeven and Levine (2008) and Maury and Pajuste (2005) define large shareholders as shareholders with a shareholding ratio of more than 10%. According to *The Companies Act of the People's Republic of China*, shareholders with a shareholding ratio of more than 10% have the right to ask the board to hold or to hold an ad hoc meeting by themselves. Moreover, they can generally send at least one director or manager to listed companies to participate in business management. This paper identifies defines large shareholders as shareholders with a shareholding ratio of more than 10%. If the firm has two or more large shareholders with shareholding ratios of more than 10%, Multi equals 1. Otherwise, Multi equals 0.

#### 3.2.3. Control variables

Drawing on the existing research (Hollindale et al., 2007; Laeven and Levine, 2008; Uwuigbe and Ajibolade, 2013), we select variables that have an important influence on CEPI as controlled variables. They are divided into three categories: (1) Corporate financial variables, including company size, financial leverage, corporate performance, and cash holding level; (2) Corporate governance variables, including company age, property right, board independence, shareholding ratio of the management, equity checks and balances, and agency cost; and (3) External influence factors, including regional environmental regulation intensity, regional sewage discharge level, and regional economic development level. The dependent variables, independent variables, and control variables are described in Table 1.

Table 1  
Variable selection and definition.

Variable symbol	Variable name	Variable description
Dependent Variable		
Epil	Corporate environmental protection investment	Environmental protection investment/Operating incomes
Independent Variable		
Multi	Multiple large shareholders	If the firm has two or more large shareholders with a shareholding ratio of more than 10%, Multi equals 1, and 0 otherwise
Control variable		
Reg	Regional environmental regulation intensity	Total investment in regional industrial pollution abatement/total investment in national industrial pollution abatement
Led	Regional economic development	The natural logarithm of real per-capita GDP in the headquarter area where the firm is located
Sdl	Regional pollution emission	Regional sewage discharge/national sewage discharge
Cash	Cash holding level	Monetary fund balance/total assets
Size	Company size	The natural logarithm of total assets
Roe	Corporate performance	Net profit/total assets
Lev	Financial leverage	Total liabilities/total assets
Age	Company age	The natural logarithm of the corporate age of listing
Soe	Property right	Takes a value of 1 when state-owned, and 0 otherwise
Cost	Agency cost	Administration expense/Operating income
Manage	Shareholding ratio of the management	Number of management shares/Total number of shares of the company
Balance	Equity checks and balances	The sum of the shares held by the second to fifth largest shareholders
Si	Board independence	The proportion of independent directors

### 3.3. Descriptive statistics and analysis

The descriptive statistics of CEPI are shown in Table 2. The mean and median of the full-sample CEPI are 0.013 and 0.0031, respectively, indicating that the mean of the ratio of CEPI to operating income is 1.3%. However, the median is much lower than the mean, suggesting that the CEPI of most sample companies has not reached the average level, which further indicates that the CEPI is generally insufficient in Chinese companies. The standard deviation of CEPI is large. The maximum and minimum are very different, indicating that there are prominent individual differences in CEPI behavior.

Descriptive statistics of the explanatory variables are shown in Table 3. The average value of multiple large shareholders, Multi, is about 0.287, indicating that 28% of the firms in our sample have multiple large shareholders. This reflects the existence of ownership concentration. The average value of property right, Soe, is about 0.768, suggesting that most of the samples belong to SOEs. The mean of regional environmental regulation intensity, Reg, and regional pollution level, Sdl, are 0.481 and 0.0404, respectively, and the maximum

Table 2  
Corporate environmental protection investment basic statistics.

Year	Obs	Mean	Median	St. Dev	Min	Max
2008	33	0.0238	0.0051	0.0431	0.00000315	0.1923
2009	40	0.0226	0.0087	0.0381	0.00000397	0.2044
2010	78	0.0119	0.0037	0.0305	0.00000152	0.1998
2011	112	0.0100	0.0029	0.0241	0.00000301	0.1902
2012	136	0.0122	0.0031	0.0388	0.00000934	0.3795
2013	148	0.0093	0.0024	0.0162	0.00000184	0.0899
2014	156	0.0135	0.0034	0.0411	0.00000277	0.3767
2015	184	0.0154	0.0026	0.0580	0.00000963	0.6907
2016	131	0.0131	0.0039	0.0238	0.0000254	0.1500
2017	122	0.0109	0.0038	0.0187	0.0000375	0.1233
Total	1140	0.0130	0.0031	0.0363	0.00000277	0.6907

Table 3  
Basic statistics for the explanatory variables.

Variable	Obs	Mean	St. Dev	Median	Min	Max
Multi	1140	0.2877	0.4529	0	0.0000	1.0000
Soe	1140	0.7675	0.4226	1	0.0000	1.0000
Reg	1140	0.0404	0.0314	0.0323	0.0001	0.1659
Led	1140	10.9378	0.4842	10.9895	9.0852	11.7361
Sdl	1140	0.0481	0.0348	0.0353	0.0007	0.1319
Roa	1140	4.0138	6.4488	3.1578	-69.0677	38.9703
Age	1140	2.3418	0.6962	2.5649	0.0000	3.2189
Cost	1140	0.0715	0.0467	0.0654	0.0057	0.6124
Lev	1140	0.5170	0.1867	0.535	0.0565	1.3447
Size	1140	23.4831	1.3969	23.3428	19.8646	27.4688
Cash	1140	0.1462	0.1058	0.1221	0.0036	0.6855
Manage	1140	0.0437	0.2040	0.0000229	0.0000	2.3164
Balance	1140	0.1312	0.1092	0.0892	0.0005	0.4755
Si	1140	0.6254	0.2654	0.5454	0.0000	2.5000

and minimum values differ greatly. This shows that the environmental regulation intensity and regional pollution level of different provinces in China are very different.

### 3.4. Model building

To investigate the relationship between large shareholders of listed companies and CEPI, the model to be tested is set as follows:

Model 1:  $Epi_{i,t} = \beta_0 + \beta_1 Multi_{i,t} + \beta_2 Reg_{i,t} + \beta_3 Led_{i,t} + \beta_4 Sdl_{i,t} + \beta_5 Cash_{i,t} + \beta_6 Size_{i,t} + \beta_7 Roa_{i,t} + \beta_8 Lev_{i,t} + \beta_9 Age_{i,t} + \beta_{10} Soe_{i,t} + \beta_{11} Cost_{i,t} + \beta_{12} Manage_{i,t} + \beta_{13} Balance_{i,t} + \beta_{14} Si_{i,t} + \varepsilon$

## 4. Empirical analysis

### 4.1. Multiple regression and analysis

#### 4.1.1. Regression results

We conduct the OLS regression on all of the samples and compare the influence of multiple large shareholders with a single large shareholder on CEPI. The results are shown in Table 5. Column (1) shows that the coefficient of multiple large shareholders, Multi, is significantly negative at the 1% level, indicating that multiple large shareholders reduce CEPI, which verifies the collusion hypothesis. Jiang et al. (2018) show that multiple large shareholders can improve corporate investment efficiency. However, our research shows that multiple large shareholders will significantly reduce CEPI, perhaps because corporate environmental investment has certain characteristics. Unlike investment in economic projects, it is difficult for corporate environmental investment to provide a company with direct economic benefits. Moreover, corporate environmental investment has the characteristics of long investment cycle and low investment income, which discourages large shareholders from CEPI.

In addition, the regression results show that the coefficient of property right, Soe, is significantly negative, suggesting that SOEs invest less in CEPI. First, as the backbone of China's national economy, SOEs' business activities are subject to government intervention. To achieve economic growth goals, the government is more inclined to invest in activities that generate economic benefits. CEPI offers limited economic benefits, so the government is less interested in intervening in CEPI. Second, compared with non-SOEs, SOEs are more likely to obtain advantages such as financing convenience, tax incentives (Adhikari et al., 2006), property rights protection, and financial subsidies (Chaney et al., 2011). In contrast, non-SOEs need to assume more social responsibility for political connection to obtain advantages, such as CEPI. Finally, SOEs have political connections. The Chinese government has great control over commercial activities. Political connection allows SOEs to face looser regulatory restrictions (Kusnadi et al., 2015). In the same institutional system, SOEs



Table 5  
Multiple large shareholders and CEPI regression results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Variable		Epi1	Epi1	Epi1	Epi1	Epi2	Epi3	Epi4
Multi	-0.0131*** (0.0043)		-0.0119*** (0.0043)	-0.00672* (0.00406)	-0.005** (0.0021)	-0.636*** (0.216)		-0.0180** (0.0078)
Multi2		-0.0152*** (0.0041)						
Soe	-0.0143*** (0.0049)	-0.0132*** (0.0047)	-0.0145*** (0.0051)	-0.0128** (0.00511)	-0.0053** (0.0021)	-0.600*** (0.148)		0.0074 (0.0046)
Reg	0.0181 (0.0263)	0.0194 (0.0264)	0.0320 (0.0276)	-0.00464 (0.0276)	0.0142 (0.0120)	4.722*** (1.700)		0.0471 (0.0653)
Led	-0.0096*** (0.0023)	-0.0083*** (0.0021)	-0.0086*** (0.0022)	-0.0106*** (0.00232)	-0.0048*** (0.0013)	-0.690*** (0.124)		-0.0034 (0.0033)
Sdl	-0.102*** (0.0269)	-0.106*** (0.0273)	-0.0992*** (0.0273)	-0.0900*** (0.0237)	-0.0449*** (0.0108)	-11.37*** (2.001)		0.0414 (0.0563)
Roa	-0.0009 (0.0006)	-0.0009 (0.0006)	-0.0009 (0.0007)	-0.0001 (0.0001)	-0.0005 (0.0004)	-0.0293** (0.0115)		-0.0001 (0.0003)
Age	-0.0029 (0.00189)	-0.0032* (0.00189)	-0.0019 (0.00166)	-0.0040* (0.0023)	-0.0022* (0.00118)	-0.245** (0.0980)		-0.0012 (0.0022)
Cost	0.0179 (0.0216)	0.0096 (0.0209)	0.0157 (0.0218)	-0.0086 (0.0190)	-0.0099 (0.0094)	-3.811*** (1.422)		0.0081 (0.0245)
Lev	-0.0161 (0.0113)	-0.0089 (0.0102)	-0.0149 (0.0122)	-0.0009 (0.0072)	-0.0093 (0.007)	-1.897*** (0.438)		0.0021 (0.0132)
Size	0.001 (0.00109)	0.0003 (0.00107)	0.0008 (0.00118)	0.0011* (0.0007)	0.0004 (0.000504)	0.984*** (0.0517)		0.0021* (0.0011)
Cash	-0.0230* (0.0120)	-0.0149 (0.0125)	-0.0181 (0.0122)	-0.0324*** (0.0081)	-0.0083 (0.0072)	-4.994*** (0.652)		-0.0331*** (0.0124)
Manage	-0.0097** (0.0047)	-0.0114** (0.0048)	-0.0054 (0.0048)	-0.0032 (0.0065)	-0.0072*** (0.0020)	-0.948*** (0.280)		-0.0064 (0.0070)
Balance	0.0006*** (0.0002)	0.0004*** (0.0002)	0.0006*** (0.0002)	0.0003 (0.0002)	0.0002** (0.0001)	0.0235** (0.0094)		-0.0001 (0.0004)
Si	0.0009 (0.0033)	0.0007 (0.0033)	0.0015 (0.0037)	0.0025 (0.0036)	0.002 (0.002)	-0.0233 (0.193)		-0.0065 (0.0049)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.119*** (0.0258)	0.117*** (0.0263)	0.0927*** (0.0228)	0.135*** (0.0309)	0.0661*** (0.0138)	8.672*** (1.688)		-0.0033 (0.0409)
N	1140	1140	1067	814	1140	1140		1,140
R <sup>2</sup>	0.178	0.179	0.171	0.205	0.119	0.450		0.1181

Note: \*\*\*, \*\*, and \* are significant at the 1%, 5%, and 10% levels, respectively. Clustered robust standard errors are shown in parentheses. Epi1 is corporate environmental protection investment divided by operating income. Epi2 is corporate environmental protection investment divided by total assets. Epi3 is the natural logarithm of corporate environmental protection investment. Epi4 is corporate environmental protection investment (under construction related to environmental issues) divided by operating income.

are less willing to invest in environmental protection than non-SOEs because they are less likely to be punished due to lack of environmental protection.

The coefficient of regional pollution discharge level, Sdl, is significantly negative, suggesting that the government may not strictly supervise environmental pollution in regions with serious pollution, which weakens firms' awareness of environmental protection. The shareholding ratio of management is negatively correlated with CEPI. Larger Shareholders have stronger control over companies when the shareholding ratio of management is higher. They may tunnel investment funds (Chen et al., 2017) or allocate CEPI funds into other economic projects for personal benefits. Both lead to a reduction in CEPI.

#### 4.1.2. Robustness test

To achieve a more reliable conclusion, this paper carries out the following robustness tests. First, we change the measurement method of multiple large shareholders. In Table 5, column (2), we define shareholders with more than a 20% shareholding ratio as large shareholders. The regression results show that the coefficient of

Multi2 is significantly negative at the 1% level. Second, we exclude some samples. The samples in 2008–2009 are far fewer than those in other years due to the 2008–2009 global financial crisis and the fact that listed companies in China began to publish CSR reports in 2008. Therefore, we retest the model after excluding the samples in 2008–2009. As shown in column (3), the coefficient of Multi is significantly negative at the 1% level. Third, we lag Multi by one period for regression because the investment behavior has a lag effect. As shown in column (4), the coefficient of Multi is significantly negative at the 10% level. Finally, we change the measurement method of CEPI. In column (5), we divide CEPI by total assets. In column (6), we take the logarithm of CEPI. Moreover, we chose the current progress on construction related to environmental issues in the notes of the financial report as the dependent variable. In column (7), we measure corporate environmental protection investment by dividing CEPI (under construction related to environmental issues) by operating income. All of the results support H1a, that multiple large shareholders will reduce CEPI.

#### 4.2. Endogeneity test

The relationship between ownership structure and CEPI may have endogeneity problems. First, according to Edmans (2014), the causal relationship between ownership structure and corporate characteristics is difficult to identify, so the investigation of the relationship between ownership structure and CEPI is susceptible to missing variables. For example, due to the Type II agency problems, large shareholders may be more inclined to collude to infringe on the interests of minority shareholders (Kahn and Winton, 1998), which may reduce corporate value (Maury and Pajuste, 2005; Laeven and Levine, 2008). Therefore, companies with multiple large shareholders may have weak performance. Shareholders often reduce CEPI to pursue investments with economic benefits. As a result, the relationship between multiple large shareholders and CEPI is affected by missing variables. Second, many companies have invested in environmental protection but have not announced specific funds. These companies cannot be included in the sample, leading to endogeneity problems regarding sample selection bias.

To consider possible endogeneity problems, we refer to Slaughter (2001) and Chen (2017). We use the fixed effect model, propensity score matching, and difference-in-differences model to solve potential endogeneity problems regarding missing variables. We use the Heckman two-stage model to solve potential endogeneity problems regarding sample selection bias.

##### 4.2.1. Fixed effect model

We use the fixed effect model to regress all of the samples to alleviate endogeneity problems caused by unobservable variables that do not change over time. The regression results are shown in Table 6, column (1). The coefficient of Multi is significantly negative at the 10% level. This indicates that this paper's conclusion is valid when controlling for possible endogeneity problems.

##### 4.2.2. Propensity score matching

We use the propensity score matching method for sample matching to address the endogeneity problems of missing variables. The matched samples obtained by this method include all of the matchable companies with multiple large shareholders and matched companies with a single large shareholder. There is no significant difference in corporate characteristics (Rosenbaum and Rubin, 1983). Referring to the method of Ben-Nasr et al. (2015), we match samples by using the nearest matching method according to a 1:1 ratio. In the probability calculation of the first stage, all of the control variables in this paper are used as independent variables. Whether companies have multiple large shareholders is considered as a dependent variable. The samples are then re-examined, and the regression results are shown in Table 6, column (2). When controlling for endogeneity problems, the coefficient of Multi is still significantly negative at the 5% level.

##### 4.2.3. Difference-in-differences model

We draw on previous research and use the difference-in-differences model to estimate the difference in CEPI before and after the change in ownership structure (Slaughter, 2001). We conduct the difference-in-differences model test by using the samples with changes in ownership structure during the sample period and the samples with unchanged ownership structure during the sample period. When the samples in the treatment group

Table 6  
Endogeneity test.

	(1)	(2)	(3)	(4)	(5)
	Fixed effects	PSM	single to multiple DID	multiple to single DID	Heckman
Variable	Epi1	Epi1	Epi1	Epi1	Epi1
Multi	-0.0113* (0.00599)	-0.0148** (0.00612)			-0.0125*** (0.00430)
Change			-0.0228*** (0.0068)	0.0005 (0.0051)	
Treated			-0.0018 (0.003)	-0.0029 (0.005)	
Soe	-0.0126* (0.0067)	-0.0099** (0.0045)	-0.0130** (0.0065)	-0.0277*** (0.0063)	-0.0110** (0.0050)
Reg	0.0523* (0.0297)	-0.0214 (0.0462)	0.0437 (0.0457)	-0.0028 (0.0401)	0.0447 (0.0274)
Led	-0.0093*** (0.0033)	-0.0090** (0.0040)	-0.0091*** (0.0025)	-0.0081** (0.0036)	-0.0089*** (0.0022)
Sdl	-0.130*** (0.0435)	-0.0829** (0.0367)	-0.198*** (0.0618)	-0.0631 (0.0495)	-0.104*** (0.0270)
Roa	-0.0008 (0.0007)	-0.0027** (0.0011)	-0.0001 (0.0002)	-0.0017 (0.0011)	-0.0009 (0.0006)
Age	-0.0025 (0.0032)	-0.0083** (0.0035)	-0.0055* (0.0031)	-0.0017 (0.0022)	-0.0031 (0.0019)
Cost	0.0337 (0.0237)	0.0103 (0.0322)	0.0045 (0.0432)	0.144** (0.0612)	0.0190 (0.0216)
Lev	-0.0182 (0.0113)	-0.0411** (0.0178)	0.0020 (0.0081)	0.00565 (0.0156)	-0.0165 (0.0112)
Size	0.0004 (0.0014)	0.0026** (0.0013)	-0.0007 (0.0017)	0.0027* (0.0016)	0.0014 (0.0011)
Cash	-0.0142 (0.0147)	-0.0156 (0.0246)	-0.0343*** (0.0102)	0.0046 (0.0204)	-0.0230* (0.0119)
Manage	-0.0107* (0.0060)	-0.0153** (0.0072)	-0.0397*** (0.0108)	-0.0153** (0.0061)	-0.0096** (0.0047)
Balance	0.0007** (0.0003)	0.0008 (0.0005)	0.0015*** (0.0004)	-0.0000 (0.0002)	0.0006*** (0.0002)
Si	-0.0004 (0.0037)	0.0135* (0.0078)	-0.0066 (0.0043)	0.0152** (0.0068)	0.0009 (0.0033)
Lambda					0.0096** (0.0047)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
_cons	0.125*** (0.0457)	0.211*** (0.0493)	0.157*** (0.0448)	0.139*** (0.0423)	0.0892*** (0.0265)
N	1140	352	768	320	1140
R <sup>2</sup>	0.0300	0.545	0.158	0.494	0.178

Note: \*\*\*, \*\*, and \* are significant at the 1%, 5%, and 10% levels, respectively. Clustered robust standard errors are shown in parentheses.

change from companies with a single large shareholder into companies with multiple large shareholders, we select companies with a single large shareholder during the sample period as the control group and exclude companies with continuous changes during the sample period (i.e., we exclude those companies that changed from a single large shareholder to multiple large shareholders and then from multiple large shareholders to a single large shareholder during the sample period). Conversely, when the samples in the treatment group change from companies with multiple large shareholders into companies with a single large shareholder, we select companies with multiple large shareholders during the sample period as the control group and excluded companies with continuous changes during the sample period (i.e., we exclude those companies that changed from a single large shareholder to multiple large shareholders and then from multiple large shareholders to a single large shareholder during the sample period). The model is as follows:

$$\text{Model 2: } \text{Epi}_{i,t} = \beta_0 + \beta_1 \text{change}_{i,t} + \beta_2 \text{Treated}_{i,t} + \beta_3 \text{Control}_{i,t} + \varepsilon$$

Change is the dummy variable before and after the change in ownership structure. When companies with a single large shareholder change to multiple large shareholders, it equals 1. Before the change, it equals 0. Treat signifies whether it is the dummy variable of the treatment group. Treat equals 1 when the sample firm belongs to the treatment group and 0 when the sample firm belongs to the control group. Control is the control variable described above. In addition, we add the year and industry dummy variables to control for the influence of macro policies, such as time trend factors and industry factors.  $\beta_1$  measures the difference in CEPI before and after the change in ownership structure. The regression results are shown in column (3) and column (4) of Table 6. Column (3) shows the change in CEPI after ownership structure changes from the single large shareholder to multiple large shareholders. Column (4) displays the change in CEPI after the ownership structure changes from multiple large shareholders to a single large shareholder. The coefficient of change in column (3) is significantly negative at the 1% level, which indicates that CEPI will decrease when the ownership structure changes from a single large shareholder to multiple large shareholders. The coefficient of change in column (4) is positive, but not significant. The reason may be that ownership structure changes from multiple large shareholders to a single large shareholder in a short time, and it takes a certain amount of time for large shareholders to change their CEPI decisions.

#### 4.2.4. Heckman two-stage model

Finally, we use the Heckman two-stage model to solve the sample self-selection problem. In the first phase, we select whether or not a firm is audited by a Big Four accounting firm, regional marketization, regional pollution regulation level, corporate property right, asset-liability ratio, and profitability as independent variables, and whether or not the firm discloses CEPI as the dependent variable, to predict the probability of the firms disclosing environmental protection investment. In Table 6, column (5), we add the inverse Mills ratio, Lambda, for the second-stage regression. The regression results are shown in column (5). The inverse Mills ratio, Lambda, is significant at the 5% level, indicating that this paper has a sample self-selection problem. The coefficient of Multi is significantly negative at the 1% level, suggesting that when controlling for possible endogenous sample selection bias, multiple large shareholders reduce CEPI, significant at the 1% level.

### 4.3. Mechanism analysis

The results in Table 6 show that multiple large shareholders have significantly reduced CEPI, but we have not verified the impact of controlling shareholders on CEPI. Consequently, we use whether the company has a controlling shareholder as an independent variable for regression. In Table 7, column (1), Cont is a dummy variable. If the company has a controlling shareholder, Cont equals 1, and 0 otherwise. The regression results show that the coefficient of Cont is significantly negative at the 5% level, which indicates that the controlling shareholder will reduce CEPI. This result is consistent with the findings of Tang and Li (2013). We divided the sample into two groups, with and without controlling shareholders, to further analyze the impact of multiple large shareholders on CEPI. Column (2) shows that in the sample with controlling shareholders, multiple large shareholders have no significant impact on CEPI. This shows that the existence of other large shareholders cannot alleviate the controlling shareholder's behavior of reducing CEPI, which does not support our supervision hypothesis. Column (3) shows that the coefficient of Multi is significantly negative at the 1% level in the sample without controlling shareholders. This shows that in non-economic investment projects such as CEPI, non-controlling large shareholders are more likely to show interest synergy and collusion tendencies.

## 5. Heterogeneity analysis

### 5.1. The role of external supervision

According to stakeholder theory, the development of an enterprise is inseparable from the input or participation of various stakeholders. Firms need to create profits for shareholders and assume responsibility for investors. At the same time, firms are required to satisfy the needs of all stakeholders to maximize their value (Harjoto et al., 2015). Therefore, enterprises should actively assume social responsibilities and establish

Table 7  
Mechanism analysis.

Variable	(1) Epi1	(2) Epi1	(3) Epi1
Cont	-0.0057** (0.0023)		
Multi		0.0031 (0.0039)	-0.0141** (0.0055)
Soe	-0.0144*** (0.0049)	-0.0025 (0.0026)	-0.0175*** (0.0065)
Reg	0.0186 (0.0263)	0.0875*** (0.0338)	0.0164 (0.0345)
Led	-0.0086*** (0.0022)	-0.0043* (0.0024)	-0.0071** (0.0028)
Sdl	-0.1038*** (0.0273)	-0.0480* (0.0289)	-0.1260*** (0.0369)
Roa	-0.0009 (0.0006)	-0.0001 (0.0001)	-0.0016* (0.0009)
Age	-0.0036* (0.0019)	-0.0031*** (0.0011)	-0.0045 (0.0035)
Cost	0.0122 (0.0217)	0.0063 (0.0128)	0.0088 (0.0346)
Lev	-0.0141 (0.0107)	-0.0062 (0.0070)	-0.0260* (0.0154)
Size	0.0012 (0.0010)	0.0003 (0.0005)	0.0022 (0.0019)
Cash	-0.0175 (0.0122)	-0.0225*** (0.0080)	-0.0225* (0.0117)
Manage	-0.0097** (0.0047)	-0.0201** (0.0101)	-0.0130* (0.0068)
Balance	0.0000 (0.0001)	-0.0002 (0.0002)	0.0006** (0.0003)
Si	0.0007 (0.0033)	0.0006 (0.0020)	0.0013 (0.0064)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
_cons	0.1117*** (0.0230)	0.0662** (0.0282)	0.0880** (0.0345)
N	1,140	447	693
R <sup>2</sup>	0.1749	0.1256	0.2114

Note: \*\*\*, \*\*, and \* are significant at the 1%, 5%, and 10% levels, respectively. Clustered robust standard errors are shown in parentheses.

friendly relations with various stakeholders. However, firms are profit-seeking and cannot meet the needs of all stakeholders. For that reason, stakeholders have sufficient motivation to supervise the fulfillment of CSR, which affects decision-making on CEPI. However, different firms face different levels of external supervision. If external supervision is weak, large shareholders may reduce CEPI to pursue economic benefits. If external supervision is strong, it will be difficult for large shareholders to reduce CEPI due to external pressure from stakeholders. To test how external supervision affects the influence of a large shareholder on CEPI, this paper uses marketization and whether the firm is audited by a Big Four accounting firm to measure the level of external supervision on firms.

### 5.1.1. Marketization

With China's marketization accelerating, market-oriented reform not only accelerates China's economic development but also makes resource allocation more empirical and justifiable. However, marketization occurs unevenly in different regions. Regions with higher marketization have greater economic development and stronger regional legal environments. In these regions, companies are highly concerned with public opin-

ion and are strongly subject to external supervision. Under the dual pressures of market competition and external supervision, companies must change their original behaviors and actively assume social responsibility. Fernández-Kranz and Santaló (2010) find that companies facing higher market competition tend to actively assume social responsibility. However, companies are more likely to make opportunistic choices and neglect CSR when they face unfair competition and market disorder. In regions with lower marketization, considering fiscal revenue, the government tends to favor local companies (Besley and Prat, 2006), thus weakening local corporate CSR awareness. Based on the above analysis, this paper assumes that multiple large shareholders have a greater negative influence on CEPI because of weak external supervision and CSR awareness in regions with lower marketization.

This paper uses the general marketization index from “China’s Provincial Marketization Index Report” (2018) by Wang et al. (2018) to measure marketization in regions where firms are located. Marketization in a region is high when the marketization index of listed companies is higher than the national average, and low when it is below the average. We divide the samples into groups for study. The regression results are shown in Table 8. Columns (1) and (2) show the influence of multiple large shareholders on CEPI in regions with high marketization and low marketization. As shown in column (1), the coefficient of Multi is negative

Table 8  
External supervision test.

Variable	(1)	(2)	(3)	(4)
	Higher marketization	Lower marketization	Audit by a Big Four accounting firm	Audit by a non-Big Four accounting firm
	Epi1	Epi1	Epi1	Epi1
Multi	−0.0049 (0.0037)	−0.0296** (0.0116)	−0.0050 (0.0044)	−0.0155*** (0.0053)
Soe	−0.0077** (0.0036)	−0.0668** (0.0277)	−0.0035 (0.0031)	−0.0154*** (0.0056)
Reg	0.0408 (0.0257)	−0.175 (0.107)	0.0858* (0.0478)	0.0230 (0.0406)
Led	−0.0120*** (0.0031)	0.0316* (0.0173)	−0.0058*** (0.0022)	−0.0076*** (0.0025)
Sdl	−0.0994*** (0.0304)	−0.411*** (0.143)	−0.0597** (0.0300)	−0.138*** (0.0362)
Roa	−0.0009 (0.0007)	−0.0010** (0.00046)	−0.0004 (0.0003)	−0.0009 (0.0006)
Age	−0.0021 (0.0014)	−0.0162* (0.0098)	−0.0005 (0.0010)	−0.0036 (0.0026)
Cost	0.0476* (0.0267)	−0.0446 (0.0701)	0.0791*** (0.0279)	0.0104 (0.0246)
Lev	−0.0134 (0.0119)	−0.0108 (0.0222)	−0.0202** (0.0083)	−0.0115 (0.0121)
Size	−0.0001 (0.0013)	0.0059** (0.0025)	0.0028*** (0.0008)	0.0010 (0.0015)
Cash	−0.0012 (0.0128)	−0.0747** (0.0327)	−0.0135* (0.0076)	−0.0249* (0.0142)
Manage	−0.0075* (0.0044)	−0.265*** (0.0970)	0.0136 (0.0095)	−0.0165*** (0.0060)
Balance	0.0003 (0.0002)	0.0027*** (0.0008)	0.0001 (0.0002)	0.0009*** (0.0003)
Si	−0.0011 (0.0033)	−0.0016 (0.0084)	0.0039** (0.0015)	0.0023 (0.0051)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
_cons	0.165*** (0.0412)	−0.426** (0.200)	0.0137 (0.0269)	0.0921*** (0.0318)
N	888	252	265	875
R <sup>2</sup>	0.202	0.422	0.327	0.186

Note: \*\*\*, \*\*, and \* are significant at the 1%, 5%, and 10% levels, respectively. Clustered robust standard errors are shown in parentheses.

but not significant in regions with high marketization, indicating multiple large shareholders have no significant influence on CEPI in regions with high marketization. Column (2) shows that the coefficient of Multi is significantly negative at the 1% level in regions with low marketization, suggesting that multiple large shareholders have a significant negative influence on CEPI in regions with low marketization. This is consistent with our previous analysis.

### 5.1.2. External audit

External audits play a key role in CSR and corporate governance. They require business managers to fulfill CSR and present a CSR report to their stakeholders. This requirement strengthens the relationship between firms and stakeholders (Kurihama, 2007). However, CSR reports are weakly supervised and constrained. Large shareholders may selectively disclose CSR information strategically or out of private motivation (Kim et al., 2012). As a result, many companies will partly disclose the specific environmental investment amount or not disclose at all. Compared with the other accounting firms, audit reports issued by the Big Four accounting firms have strong levels of independence, quality, and market recognition (Deangelo, 1981). High-quality audit reports pay more attention to the disclosure of non-financial information such as CSR, thereby improving their reliability. Disclosing CSR information is essential for companies. First, it is one of the guiding directions for investors on how to make decisions (Anderson and Frankle, 1980). Milne and Patten (2002) find that most investors make more long-term investments in companies with poor recent performance but a high level of information disclosure. Second, it can improve the transparency of corporate information and alleviate information asymmetry, thereby reducing capital costs (Dhaliwal et al., 2009) and transaction costs and improving the financing environment (Goss and Roberts, 2011). Finally, it can raise CSR awareness. Once companies disclose a high-quality CSR report, stakeholders put forward specific corresponding CSR requirements and supervise the corresponding CSR activities. External supervision is stronger after firms are audited by a Big Four. Consequently, it is difficult for multiple large shareholders to reduce CEPI. Therefore, this paper argues that compared with firms audited by a Big Four accounting firm, the large shareholders of firms audited by a non-Big Four accounting firm have a stronger negative influence on CEPI.

We divide the samples into groups for further study according to whether they are audited by a Big Four accounting firm. The regression results are shown in Table 8. Columns (3) and (4) show that multiple large shareholders have a significant negative influence on CEPI in firms audited by non-Big Four accounting firms. In contrast, multiple large shareholders have no significant influence on CEPI in firms audited by a Big Four accounting firm. This is consistent with the above analysis.

## 5.2. The role of heterogeneous ownership participation

Since the Third Plenary Session of the 18th CPC Central Committee, mixed-ownership structural reform has become a hot issue in the field of corporate governance. Megginson et al. (1994) believe that mixed-ownership structure can improve corporate performance because the participation of non-state-owned shareholders in SOEs will help ease the rigid internal management system of SOEs, thus pressuring management to improve the operating performance of SOEs. In contrast, if state-owned shareholders participate in non-SOEs, it can effectively reduce the tax burden and loosen the financing constraints of non-SOEs (Adhikari et al., 2006; Wu et al., 2002), thereby improving the operating performance of non-SOEs. However, there is currently no study on the influence of heterogeneous ownership participation on CEPI.

Non-state-owned shareholders' participation in SOEs privatizes such firms, and the government hopes that privatization benefits them (Megginson and Netter, 2001). To maintain a good image after privatization, the government often requires privatized SOEs to assume more social responsibilities. Boubakri et al. (2019) find that privatization would lead SOEs to increase their investment in socially responsible activities, as governments need to increase their corporate social responsibilities to mitigate concerns about social welfare following reform. Therefore, this paper argues that if non-state-owned shareholders participate in SOEs, it will increase the CEPI of SOEs. However, state-owned shareholders' participation in non-SOEs is based on resource control, which is often the result of political interests. The government and officials intervene in the business decisions of non-SOEs to achieve their political goals. However, in the past, the assessment of officials was based on economic performance. Environmental investment did not contribute substantially to

Table 9  
Heterogeneity participation test.

Variable	(1) Non-state ownership participates in SOEs Epi1	(2) Non-state ownership participates in SOEs Epi1	(3) State ownership participates in non-SOEs Epi1	(4) State ownership participates in non-SOEs Epi1
Private	0.0218** (0.0096)			
Pricatel			0.0082** (0.0036)	
State				0.0112 (0.0084)
Statel				0.0112 (0.0083)
Reg	0.0443* (0.0267)	0.0406 (0.0268)		0.137* (0.0701)
Led	-0.0057*** (0.0018)	-0.0063*** (0.0019)		-0.0171** (0.0066)
Sdl	-0.0915*** (0.0275)	-0.0915*** (0.0277)		-0.171*** (0.0566)
Roa	-0.0001 (0.0002)	-0.0001 (0.0002)		-0.0019** (0.0009)
Age	-0.0071*** (0.0022)	-0.0069*** (0.0022)		-0.0091*** (0.0031)
Cost	0.0243 (0.0223)	0.0227 (0.0223)		0.0372 (0.0519)
Lev	-0.0073 (0.0061)	-0.0077 (0.0063)		0.0062 (0.0198)
Size	-0.0001 (0.0011)	-0.0003 (0.0011)		0.0032 (0.0023)
Cash	-0.0185*** (0.0061)	-0.0182*** (0.0060)		0.0021 (0.0232)
Manage	-0.239** (0.107)	-0.210*** (0.0774)		-0.0166*** (0.0060)
Balance	-0.0001** (0.0001)	-0.0001 (0.0001)		0.0008*** (0.0002)
Si	-0.0020 (0.0034)	-0.0020 (0.0034)		0.0059 (0.0082)
Industry fixed effects	Yes	Yes		Yes
Year fixed effects	Yes	Yes		Yes
_cons	0.0941*** (0.0241)	0.107*** (0.0261)		0.142* (0.0806)
N	875	875		265
R <sup>2</sup>	0.143	0.138		0.566

Note: \*\*\*, \*\*, and \* are significant at the 1%, 5%, and 10% levels, respectively. Clustered robust standard errors are shown in parentheses.



officials' political goals. State-owned shareholders are not motivated to intervene in CEPI decisions. Therefore, this paper concludes that state-owned shareholders' participation in non-SOEs does not have a significant influence on CEPI.

We use the sum of the shareholding ratio of the top 10 state-owned shareholders and the sum of the shareholding ratio of non-state-owned shareholders to measure the size of heterogeneous ownership participation to test the influence of heterogeneous ownership participation on CEPI. *Private* represents the sum of the shareholding ratios of the non-state-owned shareholders among the top 10 shareholders of SOEs. If it exceeds 10%, *Private1* equals 1, and 0 otherwise. Similarly, *State* indicates non-SOEs. If it exceeds 10%, *State1* equals 1, and 0 otherwise. We report the regression results in Table 9. Columns (1) and (2) show the influence of non-state-owned shareholders' participation in the CEPI of SOEs. The coefficients of *Private* and *Private1* are both significantly positive at the 5% level, indicating that the participation of non-state-owned shareholders significantly increases the CEPI of SOEs. Columns (3) and (4) show the influence of the participation of state-owned shareholders on the CEPI of non-SOEs. The coefficients of *State* and *State1* are positive but not significant, suggesting that the participation of state-owned shareholders does not have a significant influence on the CEPI of non-SOEs, which is consistent with the above speculation.

## 6. Conclusion

Previous research has shown that environmental governance can increase corporate value (Klassen et al., 1996; Berrone and Gomez-Mejia, 2009). Based on this concept, this paper combines the characteristics of listed Chinese companies with high concentration ownership structures using data on Chinese listed companies from 2008 to 2017 to investigate the relationship between multiple large shareholders and CEPI. The results show that the governance structure of multiple large shareholders is costly. It may be more profitable for large shareholders to collude to reduce CEPI. Further research shows that the negative influence of multiple large shareholders on CEPI depends on the firm's location. Multiple large shareholders have a significant negative influence on CEPI in the firms with weak external supervision. In addition, we find that heterogeneous ownership participation influences CEPI in different ways. Non-state-owned shareholders participating in SOEs will promote the CEPI of SOEs significantly. However, the CEPI of non-SOEs does not change after state-owned shareholders participate in non-SOEs.

The policy implications of this paper are as follows. First, companies should fully consider the interests of various stakeholders, raise CSR awareness, and actively fulfill their environmental responsibility. Second, to better ensure that firms fulfill their environmental responsibility, the government should establish and improve laws and regulations for corporate environmental governance, such as enacting laws on corporate environmental protection, standardizing reporting systems on corporate environmental disclosure, and effectively implementing punishment mechanisms. Third, the Chinese government should speed up the formation of an effective supervision mechanism for supervising the fulfillment of corporate environmental responsibility, especially SOEs. In the supervision mechanism and punishment mechanism, SOEs should be treated equally with non-SOEs to improve the awareness of the environmental governance of SOEs. Finally, when shareholders of SOEs participate in non-SOEs, they should not focus solely on economic performance. Mixed-ownership structural reform should be based on economic performance and environmental performance.

While we provide strong evidence for the effect of multiple large shareholders on CEPI, this study is limited by the nature of the data. In short, only a small number of Chinese companies publish their annual specific environmental investment amount, which resulted in a relatively smaller sample in this paper. In addition, our findings may have some limitations due to the unique legal and market environment in which Chinese companies operate. We encourage future research to conduct cross-country studies and to discuss the link between multiple large shareholders and corporate environmental investments.

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