

# Study of Environmental Information Disclosure under the Hypothesis of Political Cost —Based on PM2.5 Burst Event

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**Abstract** This paper selects the A shares listed companies during 2009-2016 years on the Shanghai stock exchange as samples, and explores the influence mechanism of environmental information disclosure from the angle of political cost. The results showed that the environmental information disclosure of heavy polluting enterprises was significantly improved compared to the non-heavy polluting enterprises after PM2.5 burst event at later 2011, and it was particularly significant in the subsamples of state-owned and low-equity-concentration enterprises. It indicates that the change of macro natural environment is also one of the sources of political cost for heavy polluting enterprises, and then affects its environment information disclosure. The results are of great practical significance for establishing and improving the corporate social responsibility reporting system and strengthening the regulation of related policies.

**Keywords:** PM2.5 burst event, heavily polluting enterprises, political cost, environmental information disclosure

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## 1. Introduction

Environmental pollution is an important issue that affects the sustainable development of social economy. In recent years, malpractice from extensive exploitation of resources, irrational emission of waste, energy structure based on coal and energy intensive economic development model over a long term are increasingly exposed. Being plagued by fog and haze has become a normal phenomenon. China's annual investment in environmental governance accounts for about 1% of the total GDP. Environmental problems have become a heavy burden on the economic development. In order to alleviate the increasingly severe environmental pollution, the Ambient Air Quality Standard (GB3095-2012) incorporated PM2.5 into the environmental quality assessment system, and the State Council issued the action plan for air pollution control at the right time. Severe environmental situation has spawned urgent expression of public opinion about information disclosure.

According to annual report on the environmental statistics<sup>1</sup> released by the Ministry of environmental Protection, 80% of the pollutants who caused haze were

emitted by heavy polluting enterprises. The PM2.5 burst event increased the attention of all sectors of society to environmental governance, and brought the heavy polluting enterprises to the cusp. The political pressure faced by heavy polluting enterprises in the environmental protection is different from that in the past. It is also urgent to show determination and performance of green development to the public. Furthermore, will the level of environmental information disclosure be improved significantly? Are there any differences in the political sensitivity of heavily polluting enterprises with different property rights, different scales and different ownership concentration? It is a key point where we will analyze and empirically test in this article.

This paper regards the PM2.5 burst event in Beijing at the end of 2011 as the node of the change of political cost, and constructs a double difference model to study the changes of environmental information disclosure of heavy polluting enterprises before and after 2011. We also discriminate the sub sample of different corporate governance structure and stock ownership to study their different disclosure performance. In the past researches, there are abundant researches on the political cost hypothesis, but few people have linked the political cost to the environmental information disclosure. Environmental protection is an important part of corporate social responsibility, and the information disclosure directly forms the evaluation of social responsibility performance to corporates. Therefore, it is necessary to identify changes of

<sup>1</sup> The environmental statistics annual report of China's Ministry of environmental protection is [http://www.zhb.gov.cn/gzfw\\_13107/hjtj/hjtjnb/](http://www.zhb.gov.cn/gzfw_13107/hjtj/hjtjnb/).

environmental information disclosure caused by the changes of political cost. The results are more general and effective because the research background selected in this paper is extensive, and applying of double difference effectively eliminates the endogenous interference.

## 2. Theoretical Analysis and Research Hypothesis

### 2.1. Hypothesis of Political Cost and Disclosure Motivation

For the motivation of information disclosure of listed companies, Villiers C (2006) [1] believes that it can be explained by legitimacy. The legality was firstly proposed by the sociologist Max Weber. He believed that legality was the basis of all organizations, and the disclosure of environmental information was the embodiment of organization's compliance. The disclosure of environmental information has an irreplaceable role in guaranteeing the legitimacy and reputation of enterprises (Cormier et al, 2013) [2]. The theory of corporate citizenship holds that an enterprise is also a citizen, enjoying the rights granted by law, and undertaking corresponding obligations at the same time. In fact, as the research of Orsato (2006) [3] shows, environmental protection work does not bring direct economic benefits to enterprises, and introduction of environmental technology will instead increase operating expenses of the enterprise. Information disclosure is a way to deal with the social environment pressure faced to enterprises, and is not necessarily related to market environment and profitability. (D.M. Patten, 1991) [4]. Wu Dejun (2011) [5] obtained a similar conclusion that the environmental information disclosure level of heavy pollution companies is generally higher than those in non-heavy polluting industries due to environmental pressure. The research of Wang Jianming (2008) [6] to Shanghai market also shows that environmental information disclosure is affected by external supervision pressure, and the level of environmental information disclosure is significant in the difference between heavy polluting and non-heavy polluting enterprises. Inspection group of the law enforcement of the SCNPC disclosed that the environmental protection departments at all levels had fined billions. In face of severe environmental regulation, Zeng Yueming and Liu Jiajia (2016) [7] found that the heavy pollution enterprises took downward earnings management after PM2.5 burst, which confirmed the increasing political cost.

Clearly, the occurrence of PM2.5 explosion event enhanced people's awareness of environmental protection, and the society reexamines the protection responsibility undertaken by heavy polluting enterprises. Stringent environmental regulations promote the heavy pollution enterprises to reduce the political cost by improving the environmental information disclosure level. According to this, the following hypothesis is put forward:

H1: Compared with non-heavy polluting enterprises, heavy polluting enterprises will increase the environmental information disclosure after the PM2.5 burst.

### 2.2. The Property Right Hypothesis

After subdividing the property rights of enterprises, Yin Kai Guo (2014) [8] found that compared with the private listed companies, the political pressure of the state-owned listed companies has greater social responsibility implementation. The quality of environmental information disclosure in state-owned heavy polluting enterprises is "U", while non-state owned enterprises have inverted "U" relationship (Li Qiang, Feng Bo, 2015) [9]. The PM2.5 explosion event triggered the social demand for heavy polluting enterprises to strengthen environmental information disclosure. The Ministry of environmental protection issued the "13th Five-Year" quality management work plan for environmental monitoring, raising the level of scientific and standardized environmental monitoring work. As for the innate close ties between the enterprises and the government, and its executives have administrative compiling, the state owned enterprises are more capable and motivated to respond to the government's call to act as the leader of the environmental governance. They will also disclose more relevant information in the annual report to highlight the diligence and the effectiveness of the work. According to this, the following assumptions are put forward:

H2: Compared with non-state owned enterprises, state-owned enterprises have more motivation to improve environmental information disclosure after PM2.5 burst.

### 2.3. Scale hypothesis

A large number of previous studies usually take the scale as an alternative to political costs, and the scale hypothesis of political cost believes that more social concern for large enterprises will lead to higher political costs. Patten (1991) [10] found that large enterprises in US may be more likely to open social responsibility through annual reports and other channels. Brammer and Pavelin (2006) [11] found that the scale of UK listed companies is directly proportional to the level of environmental information disclosure. Li Wanjin (2008) [12] confirms that the level of environmental information disclosure is changing with the scale of the enterprise. It can be seen that although the market of research is different, the scale hypothesis is always established. Is the sensitivity of large-scale enterprises' political cost higher than that of small businesses? Generally speaking, the larger companies will be more concerned and supervised by government agencies, social groups and the media. Under the huge political pressure caused by haze, they are more likely to adjust the disclosure information of reports to cope with the surge of regulatory pressure and public opinion pressure. According to this, the following assumptions are put forward:

H3: Compared with small businesses, the large heavy polluting enterprises will be more motivated to improve environmental information disclosure after PM2.5 burst.

### 2.4. Ownership Concentration Hypothesis

Li Wanjin (2008) [12] takes the Herr Fender index as a measure of ownership concentration, and the result shows

that the ownership concentration has no significant influence on the level of environmental information disclosure. However, some studies also show that the higher the ownership concentration is, the lower the level of environmental information disclosure is (Morck, 2000) [13]. There is a negative correlation between the level of environmental information disclosure and the shareholding ratio of controlling shareholders (Schadewitz and Blevins, 1998) [14]. Haskins et al (2000) [15] studied the comparison of different international markets, and found that a large number of shareholders will require higher level of information disclosure due to the decentralization of European and American countries, while the share of the companies in Asia is relatively concentrated, and the requirements for the disclosure level of listed companies are low. This paper holds that, under the background of the significant increase in the political cost for the heavy polluting enterprises after the PM2.5 explosion, multitudinous small shareholders will form strong external pressure and require more information disclosure to investigate the environmental performance of the enterprise and estimate the risk of environmental regulation for the decentralized heavy polluting enterprises. The level of disclosure will be increased to meet the needs of the stakeholders. According to this, the following assumptions are put forward:

H4: Compared with heavy polluting enterprises of high equity concentration, these with low concentration of shares are more motivated to improve environmental information disclosure level after PM2.5 burst.

### 3. Research Design

#### 3.1. Sample Selection

This paper selects samples from the A-share listed companies of the Shanghai stock exchange for 2009-2016 and manually collect samples according to "bulletin on the implementation of the special emission limits of air pollutants" (The following is referred to as "bulletin") issued by the Ministry of environmental protection in February 17, 2013. Reference to the method of Liu Yunguo and Liu Mengning (2015) [16], we define the six industries registered in the controlled areas as heavy polluting enterprises, namely an experimental group. According to the guidelines for the classification of listed companies (revised in 2012), the other enterprises in the

same category of heavy polluting enterprises (the category of the alphabet code in the guidelines) are designated as non-heavy polluting enterprises, namely a control group. After excluding the samples who are under special treatment, lack of financial data, industry attribute changed, we retained 734 sample firms, including 250 in the experimental group and 484 in the control group, with a total of 5872 observations. All kinds of financial data used in this paper are derived from the CSMAR database. The environmental information disclosure data of listed companies are from annual reports and social responsibility reports published by the Shanghai Stock Exchange's official website.

### 3.2. Model Setting and Variable Definition

#### 3.2.1. Empirical Model

Referring to the practice of Liu Yunguo and Liu Mengning (2015) [16], the following double difference model is established to verify the hypothesis. The dual difference model (DID) can control the confusion effect of other events in time series and identify the causal relationship between variables more firmly.

$$\begin{aligned} EDI = & \beta_0 + \beta_1 * Treated + \beta_2 * After \\ & + \beta_3 * Treated * After + \beta_4 * Size \\ & + \beta_5 * TobinQ + \beta_6 * Roe + \varepsilon. \end{aligned}$$

The specific variable definition of the model is referred in Table 1. The word "Treated" is the indicator variable to indicate whether the enterprise is heavily polluted. The word "After" is an indicator variable of the "PM2.5 burst". What we are most interested in is the coefficient and the significance of "Treated\*After". This variable can reflect the change of environmental information disclosure level of heavy polluting enterprises after the PM2.5 burst. Assume H1 thinks its symbol is positive, that is, the environmental information disclosure level of the heavy polluting enterprises after the explosion of the table is raised.

#### 3.2.2. Variable definition

Referring to the practice of Guo Xiuzhen (2013) [17], we selected three corporate characteristic variables including growth (Tobin'Q), profit level (ROE) and company scale (Size) as control variables.

**Table 1. Definition of model variables**

Variable name	Variable symbol	Calculation explanation
Enterprise Types	Treated	Heavily polluted ones are defined 1; otherwise, it is 0.
Fiscal year	After	The year before explosion (2009 - 2010) is defined as 0; otherwise, (2011-2016) is 0.
Cross term	Treated*After	Treated*After
Company size	Size	The natural logarithm of the total assets at the end of the year
Profitability	ROE	Net profit of the year / net assets at the end of the year
Growth	Tobin'Q	Final market value / final assets
Nature	Ownership	The state ones are defined as 1, and the non-state ones are 0
Equity concentration	Concentration	Proportion of the first largest shareholder

### 3.2.3. Research Variables

This paper uses the content analysis method to measure the level of environmental information disclosure, which is based on the nine items of environmental information contents of “the encourages of enterprises voluntary

disclosure by the state” in No. thirty-fifth of the State Environmental Protection Administration. Referring to Cormier & Magnan (2013) [18], Jiang qian(2017) [19], we integrate environmental disclosure information into the following six categories:

**Table 2. Environmental information disclosure project**

Category	Project
Strategic vision and rules	Statement of measurable targets for future environmental performance
	Statement of the company's environmental policies, values and principles, environmental code of conduct
	Periodic monitoring and assessment of environmental performance.
	Executive compensation system related to environmental performance
Resource utilization	Energy consumption performance index
	Results of environmental improvement and cleaner production
	Product and operation environmental system certification
	Communication with suppliers and customers
Management system and operation	Setting up an environmental management center or a management post
	Process of environmental resources problems in company operation system
	Accountability system for specific environmental management assessment
	Environmental monitoring with independent agencies through delegation or joint operation.
	Stakeholder participation in the process of environmental disclosure
	Statement on environmental risk management and monitoring system□
Waste disposal	Substantive description of staff training related to energy efficiency management and operation
	Emergency plan for environmental accidents
	Accountability of environmental and public issues committees and independent directors
	Waste generation or management indicators
Environmental expenditure	Emission of non toxic material emissions inventory
	Performance indicators of exhaust emissions
	Independent accounting and disclosure of special environmental subsidies or deposits, sewage charges, etc.
Other voluntary public information	The environmental protection problem of independent accounting treatment and recovery cost
	Preventive cost of environmental management (input to new technology and equipment)
	Fines for environmental issues
Disclosure quality	Whether to disclose social responsibility reports or environmental reports separately
	Publicity of social environmental awareness or environmental charity
	Whether the environmental performance of the company is compared with its counterparts in the industry
Disclosure quantity	Reference to the disclosure guidelines such as the GRI Guide

According to the scale of Table 3, the six items involved in Table 2 are scored separately from two aspects of disclosure quality and quantity:

**Table 3. Environmental information disclosure level measures**

Project	Dimension	Mutator
Disclosure quality	Saliency	The assignment when the disclosure is only in the non financial part is 1,only in the financial part is 2,and the samples whose description is in two part value 3.
	Quantifying	The ones only have literal descriptions are assigned 1, quantified but non monetized are 2, and the others are assigned 3.
	Timeliness	We assign 1 when the narrative is on this year, assign 2 when there is forecast information, and assign 3 when there is comparative information.
Disclosure quantity		The number of lines that are disclosed in the annual report.

According to the above measurement method, we get the score of disclosure quality and quantity respectively. The added value of disclosure quantity and disclosure quality after Z-Score standardization is the final level of environmental information disclosure.

**Table 4. Quality and quantity score statistics of information disclosure**

Variable	Observation	Maximum	Minimum	Mean	Median	Standard deviation
Quality	5872	21	0	7.47	7	5.527
Quantity	5872	38	0	10.02	6	9.657

As shown in the statistical results of Table 4 above, the level of environmental information disclosure of listed companies in China is generally low, and some enterprises have no environmental disclosure at all in the annual reports. The mean of disclosure quality is 7.47. Compared with total score 54, there's lots of room for promotion. The average of disclosures number is also lowly 10.02. As far as dispersion degree is concerned, the maximum value is far away from the minimum value. The large standard deviation value indicates that the environmental information disclosure level of sample enterprises is uneven.

## 4. Empirical Analysis

### 4.1. Industry Distribution

The following table shows the industry distribution of the experimental group. Although the distribution of the listed companies in the experimental group is uneven, it is in line with the overall distribution of the heavy polluting enterprises in China, which can better describe the overall situation. The control samples span 27 second level industries, accounting for 30% of the 90 industry categories in the classification guidelines. It can be seen that the samples in this paper are representative, and the number of samples is large and widely distributed.

### 4.2. Descriptive Statistics

#### 4.2.1. Descriptive Statistics of Variables

Descriptive statistics of the main variables of the whole sample are shown in Table 7. To avoid extreme impact, all variables are processed in winsorization with upper and lower fractions. The average level of ROE is 0.10, which is in line with the normal market level. The largest shareholder has the largest shareholding ratio of 85.55%, with a minimum value of 13.58%. From the average of 45.60%, the concentration ratio of Listed Companies in China is generally high.

#### 4.2.2. Group Descriptive Statistics of Research Variables

From Panel A and Panel B, it can be seen that there is no significant difference in the environmental information disclosure between the two kinds of enterprises before the PM2.5 explosion. After PM2.5 burst, the difference has positive change and has passed the 1% level of significance test. The result shows PM2.5 burst event has prompted heavy polluting enterprises to improve information disclosure. From Panel C, we can see that the information disclosure of heavy polluting enterprises increased significantly after the PM2.5 explosion, but not the non-heavy polluting enterprises. The results of the descriptive analysis preliminarily verify the hypothesis H1.

**Table 5. Industry distribution of heavy pollution\***

Industry code	B07	B08	B09	C25	C26	C28	C29	C30	C31	C32	D44	Total
Frequency	2	2	11	8	72	12	17	34	23	26	43	250
Proportion	0.8%	0.8%	4.4%	3.2%	28.8%	4.8%	6.8%	13.6%	9.2%	10.4%	17.2%	100.0%

\*The second level of industry distribution shown in the previous table are from "The guidelines for the classification of listed companies" (revised in 2012). C and D represent manufacturing and electricity, heat, gas and water production and supply, respectively..

**Table 6. Control sample industry distribution**

Industry code	B06	B10	B11	C13	C14	C15	C17	C18	C19
Frequency	16	1	6	15	8	25	19	8	2
Proportion	3.31%	0.21%	1.24%	3.10%	1.65%	5.17%	3.93%	1.65%	0.41%
Industry code	C20	C22	C23	C24	C27	C33	C34	C35	C36
Frequency	5	16	5	2	70	14	33	41	34
Proportion	1.03%	3.31%	1.03%	0.41%	14.46%	2.89%	6.82%	8.47%	7.02%
Industry code	C37	C38	C39	C40	C41	C45	C46	Total	
Frequency	19	51	80	3	5	2	4	484	
Proportion	3.93%	10.54%	16.53%	0.62%	1.03%	0.41%	0.83%	100.00%	

**Table 7. Descriptive statistics of the main variables**

Variables	Observation	Maximum	Minimum	Mean	Median	Standard deviation
EDI	5872	3.65	-2.25	-0.43	-0.68	1.37
Size	5872	29.51	17.70	20.25	22.57	1.75
Tobin'Q	5872	15.28	0.20	2.57	1.64	2.24
ROE	5872	0.85	-2.52	0.10	0.13	0.27
Concentration	5872	85.55	13.58	45.60	49.51	1.52

**Table 8. Group descriptive statistics of research variables**

Panel A: Before PM2.5 burst							
Heavy polluting enterprises				Non heavy polluting enterprises			
Variables	Mean	Standard deviation	Median	Mean	Standard deviation	Median	MeanDiff
EDI	-0.36	0.961	-0.642	-0.676	1.285	-0.711	0.316
Panel B: After PM2.5 burst							
Heavy polluting enterprises				Non heavy polluting enterprises			
Variables	Mean	Standard deviation	Median	Mean	Standard deviation	Median	MeanDiff
EDI	0.72	1.359	1.133	-0.643	1.252	-0.957	1.363***
Panel C: Non heavy polluting enterprises							
After PM2.5 burst				Before PM2.5 burst			
Variables	Mean	Standard deviation	Median	Mean	Standard deviation	Median	MeanDiff
EDI	-0.643	1.252	-0.957	-0.676	1.285	-0.711	0.033
Panel D : Heavy polluting enterprises							
After PM2.5 burst				Before PM2.5 burst			
Variables	Mean	Standard deviation	Median	Mean	Standard deviation	Median	MeanDiff
EDI	0.72	1.359	1.133	-0.36	0.961	-0.642	1.08***

Note: \*\*\*, \*\*, \* respectively indicate 1%, 5% and 10% levels are significant. MeanDiff mean difference.

#### 4.2.3. Correlation Coefficient Matrix Analysis

We use the Pearson correlation coefficient among variables to preliminarily determine the correlation between variables. The correlation coefficient between EDI and Treated, Treated\*After has passed the 1% level significance test, which shows it is meaningful to study the environmental information disclosure of heavy polluting enterprises before and after PM2.5 burst. However, whether the hypothesis can be proved to depends on subsequent multiple regression analysis. In addition, Size is not related to EDI, which is inconsistent with the scale hypothesis, and initially denies the hypothesis H3. Because of the high correlation of independent variables, the interpretation effect of the model will be affected. Apart from Growth and Size, the correlation between explanatory variables is lower than 0.5 in the following table. It can be preliminarily judged that there is no high correlation between variables on the whole, indicating that the accuracy of the model is convincing.

### 4.3. Empirical Research

#### 4.3.1. Political Cost Hypothesis

From Table 10, it shows that the decisive coefficients of the model are 0.160 and 0.195, which are all less than 0.2. It shows that the model fitting effect has statistical significance. In equation (1), the symbol of Treated\*After is consistent with expectation and has passed 5% level significance test, which shows the political cost brought about by the PM 2.5 burst has stimulated the environmental disclosure motivation of heavily polluting enterprises. "After" reflects the interference effect of other events before and after 2010. The coefficient of "After" is positive but not significant. That is, there is no explanation of other events for the change of information disclosure at the same term of PM 2.5 burst. After including in the control variables, the conclusion is same as (1). Because we use the double difference model to exclude the interference of other factors, the reliability of the result is high, and the hypothesis H1 is verified again.

**Table 9. Pearson simple correlation coefficient between variables**

	Treated	After	Treated*After	Tobin'Q	Size	Roe	EDI
Treated	1						
After	0.019	1					
Treated*After	0.794***	0.335***	1				
Tobin'Q	0.258***	0.463***	-0.036	1			
Size	0.095	0.211***	-0.007	-0.531***	1		
ROE	0.087	-0.177**	-0.169**	0.166**	0.131	1	
EDI	0.350***	0.117	0.395***	-0.090	0.154	0.021	1

Note: \*\*\*, \*\*, \* respectively indicate 1%, 5% and 10% levels are significant.

**Table 10. Full sample regression results**

Variables	(1) EDI	(2) EDI
Treated	0.105 (0.772)	0.159* (1.402)
After	0.012 (0.131)	-0.036(-0.387)
Treated*After	0.308** (2.135)	0.292**(1.984)
Size		0.125(1.368)
Tobin'Q		-0.084**(-0.188)
ROE		0.075(0.957)
Observations	5872	5872
Adj-R-squared	0.160	0.195

Note: Statistical values are in parentheses, \*\*\*, \*\*, \* are significant at 1%, 5% and 10% respectively (double tail test).

### 4.3.2. Property right hypothesis of political cost

In order to test hypothesis H2, we used sub samples of state-owned and non-state-owned enterprise group to conduct regression analysis respectively. As shown in Table 11, coefficient of the non-state enterprises is not significant, but the coefficient of the other is significant, which supported the H2. Regression results show state-owned enterprises in heavily polluting enterprises have taken more action to increase environmental information disclosure to beautify the corporate image, ease the public's feelings of disgust, and avoid all possible economic and legal sanctions.

**Table 11. Group regression of distinguishing property right**

Variables	(1)	(2)	(3)	(4)
	Non-SOE	Non-SOE	SOE	SOE
Treated	0.001 (0.004)	0.301 (1.281)	0.178 (1.006)	0.177 (0.887)
After	0.076 (0.499)	-0.029 (-0.189)	-0.33 (-0.314)	-0.048 (-0.420)
Treated*After	0.141 (0.626)	0.277 (1.188)	0.400** (2.134)	0.405** (2.058)
Size		0.445 (2.164)		0.045 (0.355)
TobinQ		-0.106 (-0.610)		0.008 (0.056)
Roe		0.153 (1.134)		-0.098 (-1.045)
Observations	2520	2520	3352	3352
Adj-R-squared	0.033	0.160	0.302	0.312

### 4.3.3. Scale Hypothesis of Political Cost

As shown in Table 12, the coefficients of Treated\*After are not significant in both two groups, thus negating H3. We note that the coefficient of "After" in the large enterprise group is significant at 5% level. That is to say, PM2.5 burst has led to soaring political costs of large enterprises, leading to the improvement of disclosure. But this change is only related to the size of the enterprise, but has nothing to do with heavy polluting enterprises.

**Table 12. Grouping regression of scale**

Variables	(1)	(2)	(3)	(4)
	Big	Big	Small	Small
Treated	-0.051 (-0.180)	0.227 (0.724)	0.232 (1.44)	0.296* (1.844)
After	-0.219 (-1.92)	-0.383** (2.27)	0.117 (0.908)	0.76 (0.616)
Treated*After	0.47 (1.614)	0.38 (1.224)	0.208 (1.146)	0.276 (1.568)
Size		0.344** (2.35)		0.411*** (3.524)
Tobinq		-0.315* (-1.40)		0.080 (0.621)
Roe		0.13 (0.831)		0.025 (0.243)
Observations	2936	2936	2936	2936
Adj-R-squared	0.149	0.178	0.173	0.286

### 4.3.4. Ownership Concentration Hypothesis of Political Cost

This paper takes the median of the largest shareholder's shares number as the dividing point. In Table 13, enterprises with a high degree of ownership concentration do not changed information disclosure after the PM2.5 explosion, but other enterprises have significant change. The conclusion is consistent with the view of the external pressure theory. The supervision of public is an important source of external pressure for enterprises, and it is more prominent in large scale enterprises with dispersed ownership. A large number of small and medium shareholders in the open market will create enormous external pressure, thus affecting the information disclosure behavior of enterprises.

**Table 13. Group regression for distinguishing ownership concentration**

Variables	(1)	(2)	(3)	(4)
	Concentrated	Concentrated	Scattered	Scattered
Treated	0.018 (0.107)	0.199 (0.879)	0.136 (0.753)	0.222 (1.218)
After	-0.118 (-0.928)	-0.238* (-1.79)	0.125 (1.020)	0.033 (0.270)
Treated*After	0.266 (1.522)	0.18 (0.968)	0.366* (1.821)	0.362* (1.851)
Size		-0.167* (-1.034)		0.336*** (2.827)
TobinQ		-0.215 (-0.970)		0.035 (0.270)
Roe		-0.245* (-1.86)		0.1* (1.596)
Observations	2936	2936	2936	2936
Adj-R-squared	0.078	0.096	0.264	0.352

## 4.4. Robustness Check

This paper uses environmental disclosure quality to replace the overall disclosure. It can be found that under the condition of total samples, the coefficient of Treated\*After is positive at 5% significance level. That is, the environmental information disclosure level of heavy polluting enterprises improved significantly after the PM2.5 explosion. The sub sample of state-owned enterprise group and low ownership concentration group also passed the significant test.

## 5. Conclusion and Suggestion

This paper explored the impact of political costs on environmental information disclosure by PM2.5 burst event in 2011, using double difference model to eliminate the interference factors of the same period. We studied the shaping effect of political cost on the disclosure under the background of China's gradual entry into the new normal development, and found enterprises' environmental information disclosure is generally low, and there is a big difference between enterprises. The main contributions of this article are the following two points: Firstly, we use natural experiments to reveal the existence and

mechanism of political costs by studying the changes of corporate information disclosure. Secondly, this paper verifies the difference of political cost caused by different property rights and ownership concentration. The results show that the vicious environmental events promote the heavy polluting enterprises to improve the environmental information disclosure of their annual reports to reduce the possible huge political costs of environmental regulation. This result is especially obvious in state-owned and low-concentration enterprises, which shows that the political costs faced by different types of enterprises are different. The following suggestions are put forward.

More sound mechanisms to promote environmental information disclosure are needed to enterprises. Information disclosure is an effective way for enterprises to gain comparative advantages. The corporate governance layer should promote the reform of equity diversification, using decentralized governance model to play an active role in the information disclosure.

Local environmental protection departments should strengthen the awareness of information disclosure, and clarify their environmental supervision responsibilities. The environmental information disclosure platform should be used to disclose the monitoring information, pollution type and monitoring level of each pollutant discharge unit. In addition, environmental control must be combined with corporate characteristics because different ownership natures and governance structures respond to political pressures in different ways.

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