Journal of East Asian Studies **19** (2019), 39–59
doi:10.1017/jea.2018.32

Guangdong Xu, Wenming Xu and Binwei Gui

ADMINISTRATIVE REFORM AND ENVIRONMENTAL PROTECTION: THE CASE OF CHINA

Abstract
China's economic miracle has been achieved at considerable environmental cost. To fight against environmental pollution more effectively, the Chinese government established the Ministry of Environmental Protection (MEP) in 2008. This study investigates the stock market reaction to this event and finds that, on average, listed firms in polluting industries experienced a statistically and economically significant negative abnormal return on the event date, which implies that the compliance costs of these polluting firms are expected to increase. In addition, this study finds that enterprises with different ownership styles and different political influence experienced different price reactions during the event window. More specifically, state-owned enterprises (SOEs) in general experienced a less negative abnormal return over different event windows, and provincial SOEs perform much better than central SOEs and sub-provincial SOEs.

Keywords
administrative reform, environmental protection, stock market reaction, SOEs

1. INTRODUCTION

Environmental pollution is a serious challenge faced by the Chinese government and society. A survey conducted by the Pew Research Center in 2013 indicates that the Chinese public is becoming increasingly concerned about the state of their local environment; nearly half (47 percent) of respondents rated air pollution as a very serious problem, which represented an increase of 16 percentage points from 2008; and 40 percent considered water pollution to be a major problem in comparison with 28 percent in 2008.[1] Another survey, the sixth cohort of the World Values Survey (WVS), shows that whereas 66 percent of Chinese citizens in 1990 believed that the country's national priority should be economic growth, 56.6 percent of Chinese citizens in 2014 indicated that China's priority over the next ten years should be "protecting the environment, even at the expense of economic growth."[2] Furthermore, deteriorating environmental conditions have forced the victims of pollution, a population often lacking both the political mechanisms to participate in the decisions that may affect their lives and the legal tools to resolve their grievances against polluting enterprises and their allies (local officials), to seek more radical alternative solutions, such as protests or even riots. Unsurprisingly, the environment has thus become the leading source of social unrest in China (Economy 2014).

The Chinese government has established certain environmental governance institutions to fight environmental pollution, the role of which has been examined by the

literature extensively (van Rooij 2006; World Bank 2009; Lo et al. 2012). Unfortunately, an important actor, the central environmental regulator (hereinafter CER, referring to the Ministry of Environmental Protection (MEP) and its precursors, such as the State Environmental Protection Administration (SEPA)), appears to have garnered less attention in the literature than it deserves. When exploring China's environmental regulatory regime, most studies focus on local regulatory agencies or, more precisely, the local branches of the CER, rather than the CER per se.

This article will contribute to the literature by empirically exploring the economic impacts of the CER. More specifically, using the event study methodology developed by Campbell, Lo, and MacKinlay (1997) and MacKinlay (1997), we will examine the stock price reactions of listed companies in polluting industries to the upgrading of the SEPA to the MEP in 2008. As we will discuss in Section 2, status or rank plays a vital role in power distribution, bureaucratic interactions, and intradepartmental interplay in China's political system. The MEP enjoys a higher position in the administrative hierarchy than did its predecessor, the SEPA, and it thus acquires more power, more resources, and stronger political support from the party-state. With the help of such power, resources, and political support, the enforcement performance of China's environmental agencies (the MEP and its local branches) is expected to improve greatly. In brief, the transition from the SEPA to the MEP will result in more serious implications for polluting companies who violate environmental laws and regulations; and this leads to our first hypothesis: that their stock prices are expected to experience a negative shock during the event window.

In addition, certain politically powerful enterprises, particularly state-owned enterprises (SOEs), have been shown to enjoy preferential treatment in terms of economic policies, regulatory environment, and political status (Capital Trade Incorporated 2009; Szamosszegi and Kyle 2011). A similar situation can be found in the area of environmental regulation. For example, Wang et al. (2003) analyze the determinants of the relative bargaining power that firms may have in their relationship with local environmental authorities involving the enforcement of pollution levies; they report that SOEs appear to have more bargaining power than firms from the private sector. Similarly, Wang and Wheeler (2005) show that state ownership has a significant negative correlation with effective levy on air pollution. Consequently, SOEs are more likely to pollute or pollute more than other types of enterprises, such as privately owned enterprises (POEs) and foreign invested enterprises (FIEs) (Wang and Wheeler 2003; He, Pan, and Yan 2012; Jiang, Lin, and Lin 2014). Consequently, our second hypothesis is that, compared with listed companies with other ownership types, the stock prices of state-owned listed companies will experience smaller negative shocks.

It is necessary to notice that SOEs are not homogeneous. Chinese SOEs can be approximately divided into two groups: central SOEs and local SOEs. Central SOEs are affiliated with the central government, whereas local SOEs are owned by local governments, such as provincial governments and prefectural (municipal) governments. Different SOEs possess different administrative ranks and therefore wield different political influence (Brødsgaard 2012; Lin and Milhaupt 2013; Leutert 2016; Lin 2017). Compared with local SOEs, central SOEs possess a higher administrative rank, which "confers important political privileges that can enhance executives' ability to advocate for benefits to their companies, such as licenses, or oppose economic policies disadvantageous to their industries" (Leutert 2016, 87). For example, Sun (2015) reports that, compared with local SOEs, central

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SOEs are more likely to violate the legal prohibition on golf course construction and survive subsequent enforcement actions by the central government. Therefore, we hypothesize that SOEs with different administrative ranks will react differently to the event.

Using a sample of 309 A-shares[3] issued by listed firms in polluting industries that are traded on stock exchanges in mainland China, we find that, on average, these firms experienced a statistically and economically significant −3.6 percent abnormal return (AR) on the event date, which confirms our first hypothesis that the establishment of the MEP will improve the enforcement performance of regulatory agencies and hence increase the expected compliance costs of these polluting firms. Furthermore, the regression outputs show that SOEs, particularly those controlled by the central and provincial governments, experienced a less negative AR, which suggests that state ownership helps to ameliorate the negative impacts caused by the establishment of the MEP.

The remainder of this article is organized as follows. Section 2 offers background information on the MEP, from which we derive our basic hypotheses. Section 3 discusses the methodology and data used to quantify the impacts of the MEP. Section 4 presents the empirical results. Finally, we conclude in section 5.

2. INSTITUTIONAL BACKGROUND AND HYPOTHESES

2.1 WHY THE MEP MAY MATTER

As an important step in the Chinese government's efforts to strengthen China's environmental regulatory framework, the SEPA was enshrined with formal ministry status as the MEP, which was formally announced on March 15, 2008. Compared with its predecessors, the MEP not only has cabinet level status, but also has a vote in the State Council's decision-making processes.[4] In addition, because its status as a cabinet member is protected by law and cannot be readily changed by the State Council, the MEP's position as the central environmental protection entity has been substantially stabilized. Therefore, the establishment of the MEP has been argued to "demonstrate the strong political will and commitment of China's central government to environmental protection" (Qiu and Li 2009, 10152). A report issued by the World Bank also praises the MEP as "a particularly important milestone in strengthening the administrative system for environmental protection and reflected the elevated priority of environmental protection in the country's political and economic agenda" (World Bank 2009, 4).

It is not surprising to find that, as a response to worsening environmental conditions, the Chinese government attempts to address the problems by increasing the status of the central regulatory agency in the administrative hierarchy. As numerous studies have shown, status or rank plays a decisive role in the power distribution and bureaucratic organization of China's political system. For example, Lieberthal and Oksenberg (1988, 148) claim that "ranks play an extremely important role in structuring authority relations, and much of the routing of an issue in the policy process reflects the fact that the bureaucratic terrain is contoured by this system." More specifically, ranks are assigned to governments and functional departments at each level of the political hierarchy, and authority is predominantly wielded through superior administrative ranking (Jahiel 1998). A government office of lesser rank has no bureaucratic authority to compel compliance from one of superior rank, nor can government units of equal rank

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issue binding orders to each other. In other words, "the administrative rank of each government unit reflects its power and status" (Tsang and Kolk 2010, 183).

Numerous efforts that attempted to improve China's legal framework for environmental protection have been compromised or even nullified because of the inferior positions of the precursors of the MEP versus other powerful actors, such as non-environmental ministries and provincial governments (who care more about economic growth or certain parochial interests) (Alford and Liebman 2001; Zhu and Ru 2008). Legal enforcement is also influenced by the administrative ranking system, particularly when the regulatees are SOEs, which also have administrative ranks. The rank of an SOE signals the political and social status of its managers and workers, and a higher rank of SOE also means greater bargaining power with other governmental units, e.g., for tax reductions and subsidies (Ma and Ortolano 2000, 36). When certain SOEs have the same or even higher administrative levels than a regulator, those enterprises may completely ignore the orders and requirements from the regulator (Qiu and Li 2009).

The status of a central regulator will in turn determine the status of its local branches and hence their resource availability and enforcement performance. For example, Liu et al. (2014) report that, after the establishment of the MEP, provincial environmental agencies were also upgraded to Departments of Environmental Protection (Huanbaoting). In certain provinces, such as Guangdong, the upgrade of the provincial environmental agency to a higher administrative level resulted in the enlargement of staff establishment in city environmental agencies. One official the researchers interviewed indicated that "the bureau is now far better staffed and hence more capable of conducting enforcement actions. This has never happened before in our [bureau's] history." Another official told the researchers that "the amount of administrative fines collected from all types of violations in 2008 is higher than the total amount collected in the previous 30 years." Therefore, it is not surprising to find that, since 2010, more than 100,000 environmental cases have been investigated by the MEP and its local branches annually, and the responsible parties have accordingly received administrative sanctions.[5]

2.2 HYPOTHESES

The importance of rank or status in China's administrative hierarchy means that the elevation of China's central regulator in the environmental area to a ministerial level will lead to noticeable improvements to China's pollution control. This outcome has been confirmed by certain indirect evidence, such as interviews and raw data related to legal enforcement issued by the MEP. However, until recently, no study has been conducted to empirically examine the effects of the establishment of the MEP. We will fill this gap in the literature. More specifically, in the following sections, we will use the event study methodology to test a straightforward hypothesis, i.e., whether the stock prices of the polluting enterprises that are listed on China's stock markets will react negatively to the news that the SEPA is upgraded to the MEP (Hypothesis 1). If the establishment of the MEP indeed matters for improving China's environmental performance by, for example, enforcing environmental laws more strictly (such as initiating additional investigations and issuing more sanctions), the compliance costs of polluting listed companies will increase significantly, and the prospect of these companies will become considerably gloomy. Consequently, investors will

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"vote with their feet" by selling all or a portion of their stakes in these companies. In other words, listed polluting companies will be punished by the market.

Furthermore, we are interested in the question of whether SOEs, relative to firms with other ownership types (particularly POEs), will suffer less from the news that polluting enterprises will confront a harsher regulatory environment. As we have discussed in the introduction, SOEs are strongly favored by China's regulatory agencies, and they therefore encounter a lower compliance burden than their counterparts in the private sector. A logical inference is that the negative impacts of the establishment of the MEP on state-owned listed companies will be lower than that on listed companies with other ownership types (particularly private ownership) (Hypothesis 2A). In addition, as the literature has shown, there are significant differences within the category of SOEs. For example, Xu, Zeng, and Tam (2012) find that the price reactions of SOEs controlled by the central government to negative environmental events are different from those of SOEs controlled by local governments. This finding may reflect that SOEs controlled by governments at various levels have different administrative ranks and hence different bargaining power against regulatory agencies. Therefore, we hypothesize that SOEs controlled by governments at different levels will experience different market responses during the event windows (Hypothesis 2B). In summary, we develop three hypotheses that will be tested in the following sections:

Hypothesis 1: The listed companies in polluting industries will experience a negative AR during the event windows.

Hypothesis 2A: Compared with their counterparts in the private sector, SOEs will experience a less negative market reaction during the event windows.

Hypothesis 2B: SOEs affiliated with governments at different levels will experience different market responses during the event windows. Specifically, central SOEs will experience the least negative AR in magnitude during the event windows, and SOEs owned by sub-provincial governments (municipal governments) will experience the most; SOEs affiliated with provincial governments will be in the middle.[6]

3. METHODOLOGY, SAMPLE, AND VARIABLES

In this section, we briefly discuss the event study methodology and present our sample and descriptive statistics.

3.1 EVENT STUDY METHODOLOGY

The main research question of this study concerns how the exogenous event in which the SEPA was upgraded to the MEP affects the valuation of listed companies in polluting industries. Hence, in accordance with the event study approach developed by Campbell, Lo, and MacKinlay (1997) and MacKinlay (1997), we investigate the stock price reactions of these listed companies over different event windows. Thus, we first need to identify the event date.

The decision to establish the MEP was made during the first session of the eleventh National People's Congress (NPC), which was held between March 5 and March 18, 2008. We identify the time frame[7] for the establishment of the MEP after reading the related news and checking the schedule of the session, which can be found in Table 1. Whereas

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TABLE 1 Time Frame for the Establishment of the MEP

Date	Event
March 9	Yuqing Wang, member of the Chinese People's Political Consultative Conference (CPPCC) National Committee and the former deputy director of the SEPA, stated that the SEPA would be elevated to the MEP (covered by a news report at China.org.cn).
March 11	The delegates of the NPC debriefed Jianmin Hua, the Secretary-General of the State Council, on the State Council Institutional Reform Plan (including the plan to establish the MEP) (covered by a news report from Reuters).
March 12	The delegates of NPC reviewed the State Council Institutional Reform Plan.
March 14	The State Council Institutional Reform Plan was further reviewed.
March 15	The State Council Institutional Reform Plan was voted through.

news reports on the likelihood of establishing the MEP were few before March 15,[8] these reports may not have been taken very seriously by the market, because the plan remained under review, and no final decision had been made. Actually, most news was released only after March 15, when the State Council Institutional Reform Plan (including the plan to establish the MEP) was voted through by the delegates of the NPC.

Based on this time frame, we choose March 10 (rather than March 9, when Yuqing Wang stated that the SEPA would be elevated to the MEP, because March 9 is a Sunday, and the markets were closed), March 12 (rather than March 11, when the delegates of the NPC debriefed Jianmin Hua on the reform plan because, when Hua was reporting the reform plan to the delegates in the afternoon, the markets had been closed), and March 17 (rather than March 15, when the reform plan was voted through, because March 15 is a Saturday, and the markets were closed) as alternative event dates.

We use multiple event windows, including 1 day, 3 days [−1, 1] and 5 days [−2, 2], to estimate the ARs. The daily AR is calculated using Eq. (1).

$$\mathrm{AR_{it}} = \mathrm{R_{it}} - \hat{R}_{\mathrm{it}} \tag{1}$$

where $\mathrm{R_{it}}$ and $\hat{R}_{\mathrm{it}}$ are the daily return and expected return of stock i on day t, respectively.

The expected return $\hat{R}_{\mathrm{it}}$ is estimated using the market model, as is shown in Eq. (2).

$$\hat{R}_{\mathrm{it}} = \hat{\alpha}_{\mathrm{i}} + \hat{\beta}_i{}^{*} R_{mt} + \hat{\varepsilon}_{it} \tag{2}$$

where R_{mt} is the Shanghai Shenzhen CSI300 Index (SHSZ300) on day t used as the proxy for the return of the market portfolio,[9] and $\hat{\alpha}_{\mathrm{i}}$ and $\hat{\beta}_{\mathrm{i}}$ are estimated over a period of 150 trading days prior to the event window. To correct for the potential cross-sectional correlation, we also construct an equally weighted portfolio of our sample stocks and estimate the ARs over different event windows. We obtain data of the daily returns of individual stocks and SHSZ300 from the China Stock Market & Accounting Research Database (CSMAR), a leading financial data provider in China.

3.2 SAMPLE AND VARIABLES

We collect our sample of listed companies in polluting industries by using the following algorithm. First, we collect the data of all stocks listed on the Shanghai Stock Exchange

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(SHSE) and Shenzhen Stock Exchange (SZSE), the two main stock exchanges in mainland China whose IPOs had been completed before March 15, 2007, such that there would be sufficient trading days prior to the event for these stocks. Second, based on the Catalogue for Classified Administration of Listed Companies in Industries in Need of Environmental Inspections, which was issued by the MEP in June 2008, we target the companies in highly polluting industries, including the Industry of Mining, the Industry of Paper & Paper Products, the Industry of Oil, Chemicals and Plastics, the Industry of Metal and Non-metal Products and the Industry of Producing and Supplying the Electricity and Heat, which results in a sample of 379 stocks.

Finally, the delisted stocks, the stocks that were suspended from trading during the event window, and the stocks with less than 150 trading days prior to the event date are excluded. Consequently, we are left with a sample of 309 A-shares issued by listed companies in polluting industries. Table 2 reports the distribution of sample firms by industries and places of registration (provinces). Most of the companies fall within the Industry of Oil, Chemicals, and Plastics (34.95 percent) and the Industry of Metal and Non-metal products (31.07 percent). In addition, Shandong (7.77 percent) is the province that ranks first in attracting polluting companies, with Guangdong (7.12 percent) being the second.

We report the definition and descriptive statistics of the variables that will be used to test Hypotheses 2A and 2B in Table 3. Hypotheses 2A and 2B both concern the role of state ownership in shielding polluting companies from the negative impacts of the MEP news. Therefore, we construct a dummy variable, SOE, which indicates whether a company is controlled by the government (central or local).

In addition, Hypothesis 2B attempts to differentiate the price reactions of SOEs at different positions in the administrative hierarchy. Therefore, we further include three dummy variables distinguishing those SOEs controlled by the central government (CENTRAL) from those by provincial governments (PROVINCE) and those by sub-provincial governments (MUNICP). Compared with the SOEs controlled by local (provincial and municipal) governments, SOEs controlled by the central government have more bargaining power against regulatory agencies and therefore should suffer less from the MEP news. SOEs controlled by the central government generally have the same administrative rank as the MEP (ministry level) or simply a half-notch below a ministry and therefore act as powerful players in China's political system (Brødsgaard 2012). Provincial governments also have the same administrative rank as the MEP and therefore may protect the enterprises that are under their control from the investigation and sanction of the regulatory agencies to a certain extent.

To control for the differences in pre-event firm characteristics, we also include the following variables in our multivariate models. First, the return on assets (ROA) is included to adjust for differences in profitability. As the literature shows, the financial situation of an enterprise may influence its bargaining power against regulatory agencies (Wang et al. 2003). Li and Chan (2016) further show that profitable firms on average spend more on pollution abatement technologies. Second, we also control for the shareholding ratio of the top ten largest shareholders (TOP10) to reflect the ownership concentration. Xu, Zeng, and Tam (2012) find that, compared with their counterparts with more concentrated ownership, listed companies with dispersed ownership experience a stronger negative market response to a negative environmental event. Third, the total asset (ASSET) of listed companies is included to control for the size effect. The previous studies find that there is significant difference among enterprises in different sizes in terms of environmental performance. For example, Li and Chan (2016) report that larger firms invest more in environmental technology and

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TABLE 2 The Distribution of Polluting Companies by Industry and Province

	Mining	Paper and Paper Products	Oil, Chemicals and Plastics	Metal and Non-metal Products	Producing and Supplying the Electricity and Heat	Subtotal	Frequency
Anhui	1	1	6	5	1	14	4.53%
Beijing	1	0	1	5	4	11	3.56%
Fujian	2	1	0	5	3	11	3.56%
Gansu	1	0	0	1	1	3	0.97%
Guangdong	1	2	6	4	9	22	7.12%
Guangxi	0	1	7	1	2	11	3.56%
Guizhou	1	0	3	0	1	5	1.62%
Hainan	1	0	0	1	0	2	0.65%
Hebei	1	0	7	4	2	14	4.53%
Henan	1	1	2	6	1	11	3.56%
Heilongjiang	0	1	1	0	2	4	1.29%
Hubei	0	0	6	4	3	13	4.21%
Hunan	0	1	4	3	2	10	3.24%
Jilin	0	0	3	4	1	8	2.59%
Jiangsu	1	0	10	3	0	14	4.53%
Jiangxi	1	0	3	3	1	8	2.59%
Liaoning	0	1	2	4	5	12	3.88%
Neimenggu	1	0	4	3	1	9	2.91%
Ningxia	0	1	1	2	1	5	1.62%
Qinghai	1	0	1	1	0	3	0.97%
Shandong	5	3	9	5	2	24	7.77%
Shanxi	5	0	4	6	2	17	5.50%
Shaanxi	0	0	1	2	0	3	0.97%
Shanghai	1	0	5	5	2	13	4.21%
Sichuan	2	0	5	4	6	17	5.50%
Tianjin	1	0	0	0	1	2	0.65%
Xizang	1	0	0	1	0	2	0.65%
Xinjiang	2	0	4	3	1	10	3.24%
Yunnan	0	0	3	5	1	9	2.91%
Zhejiang	0	2	6	4	1	13	4.21%
Chongqing	1	0	4	2	2	9	2.91%
Subtotal	32	15	108	96	58	309	
Frequency	10.36%	4.85%	34.95%	31.07%	18.77%		

Note: This table reports the distribution of our sample firms by industrial classification and registered provinces. The 2001 industrial classification issued by the CSRC is used.
Data from: CSMAR.

are more likely to meet national emission standards. Similarly, Jiang, Lin, and Lin (2014) find that firms of a larger size tend to pollute less. Therefore, we hypothesize that larger firms may experience fewer negative impacts during the event window.

In addition to these variables related to firm characteristics, we also include the features of the provinces where the polluting companies registered, because environmental rules and regulations are mainly enforced by local branches of the MEP, which means that enforcement could be inconsistent across regions. First, we control for the provincial

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TABLE 3 Variable Definitions and Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.	Definition
SOE	309	0.764	0.425	0	1	Dummy variable (=1 for SOEs).
CENTRAL	309	0.188	0.391	0	1	Dummy variable (=1 SOEs controlled by the central government, 0 otherwise).
PROVINCE	309	0.307	0.462	0	1	Dummy variable (=1 SOEs controlled by provincial governments, 0 otherwise).
MUNICP	309	0.269	0.444	0	1	Dummy variable (=1 for SOEs controlled by sub-provincial (municipal) governments, 0 otherwise).
ROA	309	0.049	0.075	−0.362	0.839	Return on assets as reported in the 2007 annual reports of listed companies.
TOP10	309	56.985	15.509	15.330	96.340	The shareholding ratio of the top ten largest shareholders as reported in the 2007 annual reports of listed companies.
ASSET	309	1.043	4.426	0.011	71.857	Assets (in 10 billion CNY (Chinese Yuan)) as reported in the 2007 annual reports of listed companies.
GDPPC	309	23.965	13.946	6.915	66.367	Provincial GDP per capita (in 1 thousand CNY (Chinese Yuan)) as reported in the China Statistical Yearbook 2007, available at www.stats.gov.cn/tjsj/ndsj/2007/indexch.htm.
INDUS	309	0.431	0.078	0.081	0.548	The ratio of industrial output to GDP in the provinces where the polluting companies are registered as reported in the China Statistical Yearbook 2007, available at www.stats.gov.cn/tjsj/ndsj/2007/indexch.htm.
FDI	309	0.911	1.141	0.005	3.820	The FDI attracted at the provincial level (in 100 billion CNY (Chinese Yuan)) as reported in the China Statistical Yearbook 2007, available at www.stats.gov.cn/tjsj/ndsj/2007/indexch.htm.
ENVINV	309	1.111	0.492	0.150	3.760	Pollution abatement investment as share of GDP for different provinces in 2007 as reported in the China Environment Yearbook 2008, available at www.bjinfobank.com/indexShow.do?method=index.

GDP per capita (GDPPC), as numerous studies show that local enforcement decisions are significantly affected by local per capita income in China (Wang and Wheeler 1996; Wang and Wheeler 2005; van Rooij and Lo 2010).

Second, the ratio of the industrial output to GDP at the provincial level (INDUS) is included to control for the dependence of local governments on industrial production rather than on the service industry to maintain economic growth. On the one hand, industrial production (together with power generation and transportation) has been found to be the most important source of China's environmental pollution, particularly air pollution (Cao et al. 2011; Chong, Guan, and Guthrie 2012; Du, Wei, and Cai 2012; Zhao et al. 2013). On the other hand, because local officials in China are rewarded (by promotions or pay raises) for delivering economic growth rather than for improving environmental quality, they may undermine the effectiveness of environmental regulation to promote industrial development (and hence economic growth) (Roumasset, Burnett, and Wang 2008; Marquis, Zhang, and Zhou 2011; Wu et al. 2013; Kostka 2014; Qi and Zhang 2014).

Third, we also control for the level of foreign direct investment (FDI) in different provinces for two reasons. First, increases in FDI and the expansion of FIEs have been proven to contribute to the improvement of the environmental quality in China (Bao, Chen, and Song 2011; He, Pan, and Yan 2012; Li and Chan 2016). Second, the level of FDI may influence the performance of environmental regulation in different regions by affecting the institutional quality of the host regions (Long, Yang, and Zhang 2015), which may in turn shape the regulatory styles in different regions.

Finally, we include the ratio of pollution abatement investment to GDP (ENVINV) in different regions to control for the efforts local governments have undertaken to address pollution problems. However, it is worth noting that the real consequences of these efforts are debated. For example, Wu et al. (2013) find that there is a positive and significant correlation between environmental investment and better air quality; however, Gui, Faure, and Xu (2017) report that more pollution abatement measures are related to higher pollution levels rather than to a better environmental quality.

4. EMPIRICAL RESULTS

4.1 DETERMINING THE EVENT DATE

In accordance with the event study methodology discussed in section 3, we first estimate the ARs of individual stocks. We then calculate the mean daily ARs of the sample stocks for the 5 trading days around the alternative event dates: March 10 ± 2, March 12 ± 2, and March 17 ± 2, which can be found in Table 4 and Figure 1. After comparing the market reactions on different event dates, we decided to use March 17 as the event date, as the magnitude of market reaction is the largest on March 17.

4.2 EVENT STUDY OF THE STOCK PRICE REACTIONS

After determining the event date, we now test the three hypotheses proposed in Section 2. In this subsection, we examine the stock price reactions of polluting companies to the event that the SEPA was upgraded to the MEP. In the next subsection, we study the role of state ownership in shielding polluting companies from negative shocks and further differentiate the protecting roles played by the central government versus played by the governments at local levels.

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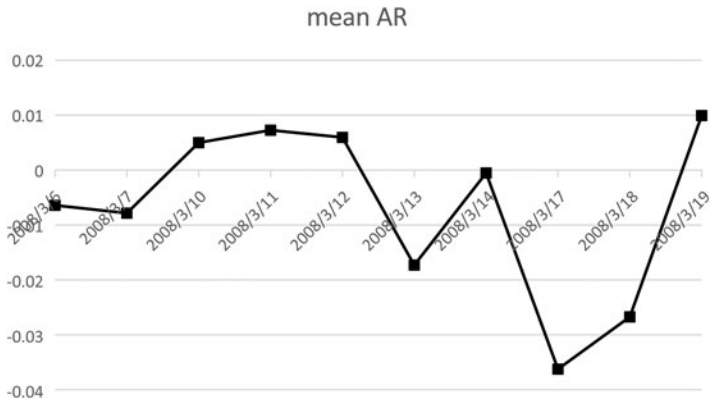
TABLE 4 Market Reactions on Different Days from 6 March to 19 March

Date	Mean	Sign-rank Test	Date	Mean	Sign-rank Test
2008/3/6	−0.0064	−5.147***	2008/3/13	−.01745	−9.241***
2008/3/7	−0.0078	−5.532***	2008/3/14	−0.0006	1.242
2008/3/10	0.0050	2.301**	2008/3/17	−0.0365	−13.658***
2008/3/11	0.0073	4.488***	2008/3/18	−0.0270	−12.160***
2008/3/12	0.0060	3.154***	2008/3/19	0.0100	6.851***

FIGURE 1 Mean AR on Different Days from 6 March to 19 March



Panel A of Table 5 presents the time series of the mean and median daily ARs of the sample stocks for the 5 trading days around the event date. The number of positive versus negative ARs for each trading day and the results of the Wilcoxon signed-rank test are shown in the last two columns. On average, the sample stocks experience −3.6 percent and −2.7 percent ARs on the event date and the day after, respectively, which are significantly different from zero, as is shown by the Wilcoxon signed-rank test in the last column. To correct for potential correlations among individual stocks, we construct an equally weighted portfolio of our sample stocks. In Panel B of Table 5, we calculate the average abnormal return (AAR) of the portfolio over the 0, [−1, 1] and [−2, 2] event windows with the regression method suggested by Gelbach, Helland, and Klick (2013). The t-statistics reported in the parentheses also indicate that the AARs are significantly different from zero over the three chosen event windows. The AAR decreases as we expand the event window from −3.6 percent on the event date to −1.4 percent over the [−2, 2] event window.

We also report the 18-day time series of the daily abnormal return and cumulative abnormal return of the portfolio around the [−7, 10] window in Figure 2a. The figure shows that the portfolio experiences significant negative ARs on the event date and the day after compared with those on other trading days, which provides supporting evidence that our estimated effects are mainly driven by the exogenous event (the MEP news). Overall, the results show that the prices of the A-shares issued by listed companies in polluting industries decrease significantly following the event that the SEPA was upgraded to the MEP, thereby providing supporting evidence for our first hypothesis.

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We further report the daily abnormal return and cumulative abnormal return of SOEs at different levels around the [−7, 10] window in Figure 2b. An interesting phenomenon emerges. Whereas SOEs as a whole experience a less negative market reaction, which is consistent with Hypothesis 2A, and both central SOEs and provincial SOEs experience a less negative market reaction than sub-provincial SOEs, which partly supports Hypothesis 2B, provincial SOEs experience a less negative market reaction than central SOEs rather than vice versa, which is inconsistent with Hypothesis 2B. We will attempt to explain this anomaly in conclusion.

TABLE 5 Stock Price Reactions to the Exogenous Shock

Panel A: Daily Abnormal Returns of Individual Stocks

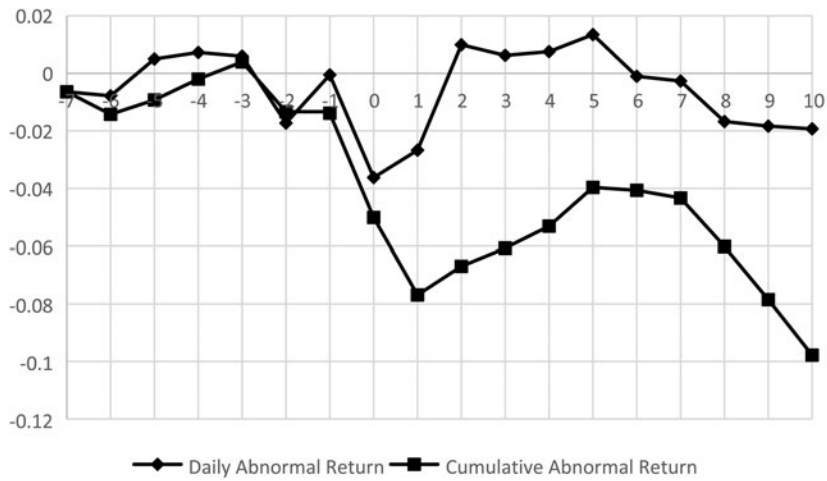
Trading days	Sample size	Mean AR	Median AR	Positive:Negative	Sign-rank Test
−2	309	−.01745	−0.0196	63:246	−9.241***
−1	309	−0.0006	0.0040	182:127	1.242
0	309	−0.0365	−0.0427	30:279	−13.658***
1	309	−0.0270	−0.0337	45:264	−12.160***
2	309	0.0100	0.0104	217:92	6.851***

Panel B: Average Abnormal Returns of the Portfolio

Event window	(0)	(−1,1)	(−2,2)
AAR	−0.0364 ***	−0.0209 ***	−0.0139 ***
	(0.0115)	(0.0068)	(0.0053)
Sample size	309	309	309

Note: This table shows the stock price reactions to the exogenous event of the establishment of the MEP. Panel A reports the mean and median AR for each trading day from two days before the event date to two days after. In addition, we report the number of positive versus negative stock price reactions and the results of the Wilcoxon signed-rank test in the last two columns. Panel B shows the AAR for various event windows. The standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

FIGURE 2A The 18-day Daily Abnormal Return and Cumulative Abnormal Return of the Portfolio



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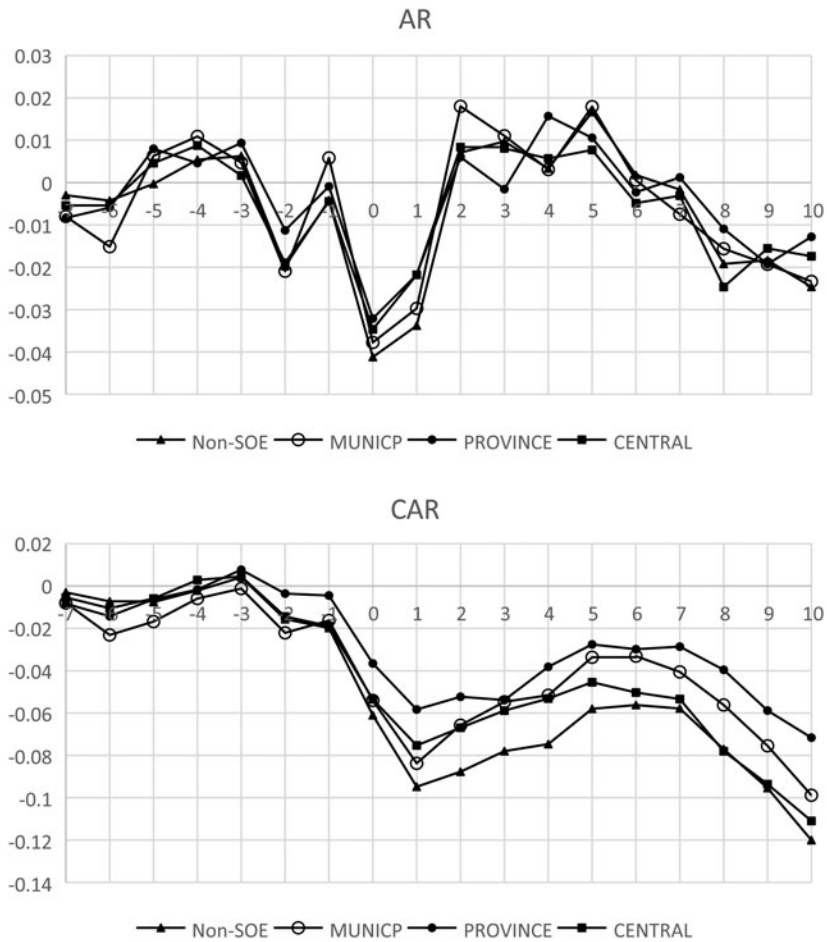
There are further implications that can be derived from the empirical results here. First, contrary to the common myth that China's stock markets are inefficient and that the prices of stocks are therefore not suitable indicators for the intrinsic values of listed companies (Morck, Yeung, and Yu 2000), the market or, more precisely, the investors indeed react to the MEP news in a reasonable and predictable manner. The stock markets in China may not completely adhere to the efficient market hypothesis; however, at least they are informative. Therefore, to a certain extent our findings here support the conclusion of Carpenter, Lu, and Whitelaw (2015, 1), who claim that "stock prices in China have become strongly linked with firm fundamentals and appear to play an important role in aggregating diffuse information and generating useful signals for managers."

FIGURE 2B The 18-day Daily Abnormal Return and Cumulative Abnormal Return of SOEs at different levels



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Second, SOEs are expected by the market to enjoy favoritism in regulatory enforcement. This is certainly not a new finding. As the previous literature shows, close connections with the party-state not only protect SOEs from public enforcement of certain laws and regulations, but also bring them material benefits.[10] SOEs are favored by the party-state for a simple reason: they are part of the patronage system established by the party-state to exchange material and non-material benefits for loyalty and support. The party-state's patronage strategy appears to work considerably well, as employees in the state sector show more support for the party-state than their counterparts in the private sector and SOEs serve the interests of the party-state enthusiastically by, for example, maintaining employment to achieve social stability (Xu and Faure Forthcoming).

A potential caveat regarding our findings is that the estimated effects are short-term and could be transient due to the choice of the (−2,2) event window. However, we believe that event studies over short-horizons are comparatively more effective in finding a clean market reaction to the establishment of the MEP, which is the main goal of this article. Generally speaking, stock prices reflect new information in a timely manner when the market is efficient enough.[11] Our sample stocks indeed experienced significant negative abnormal return around −3.65 percent and −2.7 percent on the event date and the day after, which is consistent with our predictions. Although the daily ARs of the sample stocks vary after the event date, the CAR is always negative as is shown in Figure 2a. We are therefore quite confident that these short-term results are appropriate estimates for the market reaction to the event.

4.3 ARE SOES PROTECTED FROM NEGATIVE SHOCKS? A FURTHER INVESTIGATION

In this subsection, we further test Hypotheses 2A and 2B concerning the role of state ownership in protecting polluting companies from the exogenous negative shock that the SEPA was upgraded to the MEP. As is shown in the previous subsection, the stock prices adjust quickly during the (0, 1) event window. Therefore, we choose the AR on the event date and the AAR over the (0, 1) event window as the dependent variables. The empirical results are reported in Table 6. In the first four columns, the regression results with our proxies for state ownership and industrial dummies are reported. In columns 1–2, we employ the dummy variable SOE as the main explanatory variable. As is shown in column 1, SOEs on average experience a smaller negative shock (approximately 0.6 percent) on the event date. Similarly, the result in the second column shows that, on average, SOEs experience less negative market reactions (approximately 0.8 percent) over the (0,1) event window. Therefore, Hypothesis 2A is confirmed by our data.

In the third and fourth columns, we further include three dummy variables, CENTRAL, PROVINCE and MUNICP, which partition our sample into four groups, i.e., SOEs controlled by central, provincial, and sub-provincial governments and POEs. Similar to the findings in Section 4.2, we find that provincial SOEs perform better not only than municipal SOEs but also than central SOEs. The significant and positive coefficients of PROVINCE (0.9 percent on the event date and 1.0 percent over the (0, 1) event window) suggest that SOEs controlled by provincial governments suffer much less from the negative shock than POEs. The coefficient of CENTRAL is smaller than that of PROVINCE (0.6 percent on the event date and 0.9 percent over

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TABLE 6 The Role of State Ownership in Shielding Polluting Companies

Variable	AR(0) (1)	AAR(0,1) (2)	AR(0) (3)	AAR(0,1) (4)	AR(0) (5)	AAR(0,1) (6)	AR(0) (7)	AAR(0,1) (8)	AR(0) (9)	AAR(0,1) (10)	AR(0) (11)	AAR(0,1) (12)	AR(0) (13)	AAR(0,1) (14)	AR(0) (15)	AAR(0,1) (16)
SOE	0.006*	0.008***			0.006	0.007**			0.005	0.006**			0.004	0.007**		
	(0.004)	(0.003)			(0.004)	(0.003)			(0.004)	(0.003)			(0.004)	(0.003)		
CENTRAL			0.006	0.009**			0.003	0.007*			−0.00001	0.004			0.0001	0.005
			(0.005)	(0.004)			(0.005)	(0.004)			(0.005)	(0.004)			(0.005)	(0.004)
PROVINCE			0.009**	0.010***			0.008*	0.010***			0.009**	0.010***			0.010**	0.013***
			(0.004)	(0.003)			(0.004)	(0.003)			(0.004)	(0.003)			(0.005)	(0.004)
MUNICP			0.003	0.004			0.004	0.005			0.003	0.003			0.002	0.004
			(0.004)	(0.003)			(0.004)	(0.003)			(0.004)	(0.003)			(0.004)	(0.003)
ROA					0.066***	0.054***	0.065***	0.054***	0.066***	0.055***	0.065***	0.054***	0.056**	0.048***	0.054**	0.047***
					(0.021)	(0.016)	(0.021)	(0.016)	(0.021)	(0.016)	(0.021)	(0.016)	(0.022)	(0.017)	(0.022)	(0.017)
TOP10					0.0002*	0.0001	0.0002	0.0001	0.0002	0.0001	0.0001	0.00004	0.0002*	0.0001	0.0002	0.0001
					(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ASSET					0.001***	0.001***	0.001***	0.001***	0.001**	0.001***	0.001**	0.001***	0.001**	0.001***	0.001**	0.001***
					(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0003)
GDPPC									0.0004**	0.0002*	0.0005***	0.0003**				
									(0.0002)	(0.0001)	(0.0002)	(0.0001)				
INDUS									−0.007	−0.005	−0.014	−0.008				
									(0.024)	(0.019)	(0.025)	(0.019)				
FDI									−0.003	−0.003	−0.003	−0.003				
									(0.002)	(0.002)	(0.002)	(0.002)				
ENVINV									0.002	0.001	0.003	0.001				
									(0.003)	(0.003)	(0.003)	(0.003)				
Constant	−0.040***	−0.036***	−0.040***	−0.035***	−0.055***	−0.044***	−0.054***	−0.042***	−0.059***	−0.044***	−0.057***	−0.043***	−0.061	−0.054	−0.068	−0.061
	(0.005)	(0.004)	(0.005)	(0.004)	(0.008)	(0.006)	(0.008)	(0.006)	(0.013)	(0.010)	(0.013)	(0.010)	(0.048)	(0.038)	(0.048)	(0.037)
R^2	0.013	0.028	0.019	0.043	0.108	0.141	0.112	0.150	0.131	0.156	0.144	0.170	0.187	0.222	0.202	0.244
Obs.	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309

Note: This table shows the determinants of the stock price reactions to the exogenous event that the SEPA was upgraded to the MEP. The dependent variables are the AR on the event date and AAR over the (0,1) event window. Each model contains industry dummy variables. Model 13–16 contains regional dummy variables (regional fixed effect). The standard error clustered at the provincial level is reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

the (0, 1) event window) and is significant only over the (0, 1) event window. The coefficient of MUNICP is the smallest (0.3 percent on the event date and 0.4 percent over the (0, 1) event window) and is not significant, which implies that SOEs controlled by municipal governments are expected to garner less political support than their counterparts at the central and provincial level and will be treated similarly as POEs are by the regulators.

To adjust for the pre-event differences among our sample firms, we include a variety of control variables, including ROA, TOP10, and ASSET, which concern firm characteristics, and GDPPC, INDUS, FDI, and ENVINV, which are related to the features of the regions where the sample firms are located. To better differentiate the contributions of firm-level variables from those of region-level variables, we run the regressions in two steps: only firm-level covariates are included in the first model, and region-level covariates are further included in the second model. It is found that the contribution to the model goodness of fit (GoF) is mainly from firm-level variables rather than region-level variables, as the R-squared value increases by approximately 0.1 (from approximately 0.03 to 0.13) by including firm-level variables, whereas the R-squared value increases by approximately 0.03 (from approximately 0.13 to 0.16) by including region-level variables. In other words, firm-level characteristics dominate region-level features in affecting listed companies' price reactions.

The coefficients of the variables and the level of significance between these two models are basically identical; therefore, we report the results of the two models simultaneously to save space. The regression results for SOE are reported in columns 5–6 and 9–10, and we mainly discuss the results in columns 6 and 10 (the (0,1) event window). The coefficient of SOE is approximately 0.7 percent in the first model and 0.6 percent in the second model, which is smaller than that reported in the second column (0.8 percent), but it remains significant at the 5 percent level. Therefore, after controlling the firm-level characteristics and region-level features, Hypothesis 2A is still supported.

In columns 7–8 and 11–12, we report the regression results with CENTRAL, PROVINCE and MUNICP as the main explanatory variables. We mainly discuss the results in columns 8 and 12 (the (0,1) event window). Similar to the previous results, the coefficient of PROVINCE remains the largest (1 percent in both columns) and is significant at the 1 percent level. The coefficient of CENTRAL is smaller than that of PROVINCE (0.7 percent and 0.4 percent, separately), and the coefficient becomes insignificant after including the region-level control variables. The coefficient of MUNICP is the smallest (0.5 percent and 0.3 percent, separately) and is not significant.

The regression results for firm-level variables are reported in columns 5–12. Because the results are basically the same, we mainly discuss the results in columns 10 and 12. ROA has a coefficient of 0.055 (0.054) and is significant at the 1 percent level, which means that companies with greater profits experience less negative market reactions, which is in conflict with the findings of Wang et al. (2003), who claim that firms encountering an adverse financial situation have more bargaining power against the regulatory agencies. The coefficient of TOP10 is 0.0001 (0.00004) and insignificant, which means that ownership concentration is not as helpful as argued by Xu, Zeng, and Tam (2012) in alleviating the shock of a negative event. The coefficient of ASSET is approximately 0.001 and significant at the 1 percent level, suggesting that larger firms perform better when encountering a negative shock to the polluting industry, which is consistent with

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previous studies showing that larger firms have better environmental performance (Jiang, Lin, and Lin 2014; Li and Chan 2016).

The regression results for region-level variables are reported in columns 9–12, and we mainly discuss the results in columns 10 and 12. The coefficient of GDPPC is positive and significant (0.0002 and 0.0003), which suggests that the MEP event has a smaller impact on those firms that those located in more prosperous regions. As the literature has shown, regulation is stricter in areas where incomes are higher (Wang and Wheeler 1996; Wang and Wheeler 2005; van Rooij and Lo 2010); therefore, it may be argued that polluting companies in richer regions have previously accommodated themselves to a stricter regulatory environment (and hence have achieved a higher environmental standard). Consequently, the negative impacts encountered by these companies as a result of the establishment of the MEP will be smaller than their counterparts in poorer regions where the environmental regulations are weaker. The coefficient of INDUS is negative (−0.005 and −0.008) but not significant. FDI has a negative and insignificant coefficient (approximately −0.003). The coefficient of ENVINV is positive (approximately 0.001) but insignificant, which raises questions on the real effects of pollution abatement investments committed by local governments in addressing environmental pollution.

In the last four columns (column 13–16), we rerun one set of models with the province fixed effect as a robustness check. Whereas the coefficients of SOE, CENTRAL, PROVINCE, and MUNICP are slightly different from those reported in previous columns, the levels of significance are the same. In summary, Hypothesis 2A is confirmed and Hypothesis 2B is partly confirmed by our empirical results. Therefore, we may conclude the following: 1. SOEs in general are better protected from regulatory agencies; 2. higher administrative ranks enjoyed by SOEs do not necessarily translate into greater bargaining power against regulatory agencies; 3. consequently, we may find a non-linear relationship between administrative ranks of SOEs and their net political benefits, i.e., SOEs at the intermediate level (province level) may benefit the most from their connections with the government.

5. CONCLUSION

In this study, we use the event study methodology to examine the stock price reactions of the listed companies in polluting industries to the establishment of the MEP. Using a sample of 309 listed firms in polluting industries, we find that, on average, these firms experienced a statistically and economically significant negative abnormal return on the event date. This finding means that the establishment of the MEP is believed to matter when addressing China's environmental problems by initiating investigations and sanctions against polluting companies more frequently and more extensively. Therefore, polluting companies are expected to assume higher compliance costs, and their stock prices then decline accordingly.

In addition, we explore whether SOEs are favored by regulatory agencies in the area of environmental protection, as is suggested in the previous literature. We compare the price reactions of SOEs with those of POEs and find that SOEs in general experienced a less negative AR over different event windows; this suggests that polluting companies with state ownership indeed enjoy a friendlier regulatory environment than their counterparts in the private sector.

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Finally, we compare the performances of SOEs at central, provincial, and sub-provincial levels, given the advent of a more powerful regulatory agency. To our surprise, we find a non-linear relationship between the administrative rank of SOEs and their price reactions to the establishment of the MEP. Provincial SOEs perform much better than central SOEs and sub-provincial SOEs.

The last finding is to certain extent inconsistent with our hypothesis 2B, and therefore needs further explanation. Rank certainly plays an important role in the power distribution and bureaucratic organization of China's political system, and hence influences the relationship between SOEs and regulatory agencies in certain areas. In general, it may be argued that the higher the rank, the more bargaining power a SOE may hold. In that sense, central SOEs are more powerful than provincial SOEs and therefore enjoy better protection from regulatory enforcement.

However, rank is not the only factor that may influence the interaction between SOEs and regulatory agencies in particular and the party-state in general. Both central and provincial SOEs follow orders from their (single or controlling) shareholder: the central government and provincial governments. However, the central government and provincial governments are different political actors. The central government has a broad policy portfolio and tends to use central SOEs as a tool to implement certain policies when necessary. For example, facing the global financial crisis of 2008, central SOEs were mobilized to expand investment in a broad range of sectors to reinvigorate China's economy (Deng et al. 2015: Li 2016). Similarly, central SOEs are more enthusiastic in reacting to the Chinese government's "one belt one road" initiative.[12] Therefore, when the Chinese central government adopts a new policy, such as emphasizing environmental protection, it may not only revise the legal framework and improve the status of regulatory agencies, but also pressure central SOEs to comply with environmental laws and regulations more rigorously. Therefore, the protection enjoyed by central SOEs (from their rank) may be counterbalanced by the political pressure, and their bargaining power versus regulatory agencies may be weakened.

In contrast, provincial SOEs serve the interests of provincial governments, or more precisely, provincial leaders. As the literature shows, these leaders continue to be rewarded for economic growth rather than for improving the environmental quality and enjoy considerable discretionary power in law and policy enforcement (Xu and Faure 2016). Therefore, before the incentive structure of these local leaders can be changed, provincial SOEs will not be pressured to comply with environmental regulations, despite the policy signal sent by the central government.

In summary, central SOEs enjoy a higher administrative rank, but also face a heavier political pressure to comply with the policies adopted by the central government. If market participants estimate that, for polluting SOEs, the negative effects of increasing political pressure cannot be counterbalanced by the positive effects of increasing administrative ranks, we may witness that central SOEs are less favored than provincial SOEs, as the evidence shows.

Our study therefore reaches a more subtle conclusion regarding the enforcement environment faced by China's SOEs: *rank matters, but so do other factors*. In addition to political pressure that we have just discussed, it is not unreasonable to imagine that there are other factors, such as the closeness to the party-state (whether the CEO of a SOE is a member of the central committee of the Communist Party of China or a delegate

https://doi.org/10.1017/jea.2018.32 Published online by Cambridge University Press

of the National People's Congress), industry policies, competition environment, etc., may also influence the interaction between SOEs at different levels and regulatory agencies. We look forward to further works on this topic.

Guangdong Xu (corresponding author, guangdongx@cupl.edu.cn) is a Professor of Law and Economics at the School of Law and Economics (SLE) at the China University of Political Science and Law (CUPL). His research focuses on law and economic growth, financial regulation, and China's political economy.

Wenming Xu is an Associate Professor of Law and Economics at the SLE at the CUPL. His research focuses on empirical legal studies, financial regulation, and corporate finance.

Binwei Gui is an Associate Professor of Law and Economics at the SLE at the CUPL. His research focuses on China's economic growth, financial regulation, and anti-monopoly law.

NOTES

We gratefully acknowledge the financial support from the Program for Young Innovative Research Teams of the CUPL (project number 16CXTD 09). We would like to thank Professor Stephan Haggard (the editor) and two reviewers for their valuable comments.

1. Pew Research Center. 2013. "Environmental Concerns on the Rise in China." www.pewglobal.org/2013/09/19/environmental-concerns-on-the-rise-in-china/. Accessed July 3, 2015.

2. Escarfullett, Maryan. 2014. "56 Percent of Chinese Say Environment More Important Than Growth." http://thediplomat.com/2014/09/56-percent-of-chinese-say-environment-more-important-than-growth/. Accessed July 3, 2015.

3. Shares of publicly traded companies in mainland China generally fall under three categories: A-shares, B-shares and H-shares. A-shares are generally available for purchase and trading only by mainland Chinese citizens. B-shares are quoted in foreign currencies (such as the U.S. dollar) and are open to both domestic and foreign investment. Finally, H-shares are the shares issued by publicly traded Chinese companies listed on the Hong Kong Stock Exchange and are therefore subject to the Hong Kong Stock Exchange's listing requirements (in accordance with Chinese law concurrently).

4. Qiu and Li (2009) report that the SEPA could not participate in the State Council's annual meeting, during which all important national decisions are made, unless invited to testify. Typically, the SEPA was allowed only to sit in the annual meeting and give its opinions based on the need of the State Council. However, the latter had complete discretion to decide whether to adopt the SEPA's suggestions. Consequently, the SEPA did not have direct influence on the country's major decision-making process, and environmental perspectives could easily be ignored. In contrast, as a ministry, the MEP has the legal authority to vote on the State Council's decisions, and its opinions will likely not become marginalized.

5. MEP. 2010, 2011, 2012, 2013. Annual Reports of Environmental Statistics. Accessed www.mep.gov.cn/zwgk/hjtj/. August 3, 2015.

6. We thank an anonymous referee for his/her advice on refining Hypothesis 2B.

7. We thank an anonymous referee for his/her advice on doing this.

8. "The State Environmental Protection Administration will be upgraded to the Ministry of Environmental Protection. " http://finance.sina.com.cn/china/hgjj/20080311/11314606943.shtml. Accessed January 13, 2019; "China again vows cleaner air for Beijing." Reuters, 2008, www.reuters.com/article/environment-olympics-pollution-dc/china-again-vows-cleaner-air-for-beijing-idUSPEK27317420080312. Accessed April 2, 2018. We thank an anonymous referee for reminding us of these reports.

9. SHSZ300 is a capitalization-weighted market index constructed by the China Securities Index Co., Ltd, which selects sample stocks based on market capitalization and liquidity.

10. See Xu and Faure (Forthcoming) for a literature review on this issue.

11. The short-term event study methodology has been widely used in financial studies. For certain seminal works, see Fama (1991 and 1998). Berkowitz. Lin, and Ma (2015) recently applied this methodology to a study of China's Property Law enactment.

12. See, for example, "Yidaiyilu, zhongguo qiye douzai zuoshenmo" (One belt one road: what are Chinese firms doing?), Yiou Think Tank. 2017. www.iyiou.com/intelligence/insight56440.html. Accessed August 7, 2018.

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https://doi.org/10.1017/jea.2018.32 Published online by Cambridge University Press