Central Environmental Protection Inspector and Stock Price Crash Risk – Evidence from Polluting Industries Firms in China

Mengyao Wen (1506691288@qq.com)
Shanghai University of Finance and Economics https://orcid.org/0000-0003-1153-3040

Research Article

Keywords: CEPI, stock price crash risk, polluting industry, China, stock price bubble, list firms

Posted Date: April 12th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1485785/v1

Central Environmental Protection Inspector and Stock Price Crash Risk -- Evidence from Polluting Industries Firms in China

Author

Mengyao Wen

School of Finance, Shanghai University of Finance and Economics, Shanghai 200433, China;

1506691288@qq.com (M.W.)

Full postal address: School of Finance, Shanghai University of Finance and Economics, 777 Guoding Road, Yangpu District, Shanghai 200433, China

Corresponding author

Correspondence to Mengyao Wen

Central Environmental Protection Inspector and Stock Price Crash Risk -- Evidence from Polluting Industries Firms in China

Abstract: In recent years, under the background of vigorously promoting environmental governance, the implementation effect of the central environmental protection inspection is an issue of great concern to the government and the public. This paper systematically investigates the impact of central environmental protection inspection on the risk of stock price crash using a sample of listed firms in polluting industries. The results show that compared with non-supervised areas, central environmental protection inspection can reduce the polluting industries firms' stock price crash risk by reducing stock price bubbles. After a series of robustness tests, the results still held. The above transmission mechanism is more effective in the samples of private enterprises, low information transparency and disclosure quality enterprises, non-national civilized urban areas and high promotion incentive areas. Furthermore, this paper found that there were differences in the effects of central environmental protection inspection in different batches. Among the effects of central environmental protection inspection in different batches, the effect of environmental regulation in the second, third and fourth batches was better, and the effect of central environmental protection inspection in different batches gradually deepened. Finally, by analyzing the environmental governance of the central environmental protection inspection, it is found that the central environmental protection inspection has significant short-term and long-term control effect in air pollution governance, and it is still necessary to strengthen the law enforcement in water pollution governance.

Key Words: CEPI; stock price crash risk; polluting industry; China; stock price bubble; list firms

I. Introduction

China's rapid economic development has also brought about many environmental problems, such as water, soil and air pollution. The increasingly prominent ecological and environmental problems have attracted the attention of the central government, which has gradually formulated corresponding environmental governance acts. on April 24, 2014, the eighth meeting of the Standing Committee of the 12th National People's Congress amended the Environmental Protection Law of the People's Republic of China, which clearly established environmental protection as a basic state policy. The implementation effect of environmental policies has been a key concern of the relevant authorities, but due to the strength of local government environmental enforcement and the low cost of environmental violations by enterprises, the implementation effect of environmental policies has not been satisfactory.

Compared with previous environmental policies, the Central Environmental Protection Inspector (CEPI) has made the results of the inspectors an important basis for the assessment and appointment of leading cadres, increased the assessment of local governments' environmental performance, enhanced local governments' enforcement efforts, and improved the problems of poor policy implementation and difficult accountability of local governments in the process of environmental governance. Scholars have studied the implementation effect of CEPI in terms of environmental quality improvement (Wu and Hu, 2019; Jia and Chen, 2019; He and Geng, 2020; Zhang et al., 2018), corporate stock value (Tian et al., 2019), and capital market response (Zeng et al., 2021), respectively. Then, in a market environment where China's environmental regulatory system is not yet perfect, whether CEPI can have a good effect on environmental

information disclosure, reduce the hoarding of negative corporate information and reduce the risk of corporate stock price crash risk. Whether there are differences in the effects of CEPI between batches. The answers to the above two questions help us further assess the effectiveness of the implementation of the CEPI policy.

The existing literature examining the causes of stock price crash risk focuses on both internal corporate governance factors (Hutton et al., 2009; Xu et al., 2014) and external environmental factors (Hong and Stein, 2003; Callen and Fang, 2015), and concludes that information opacity from the cover-up of negative news is an important cause of crash risk. Few scholars have analyzed the formation of stock price crash risk from the perspective of environmental information disclosure. Our study is a strong addition to the relevant literature.

We find that CEPI reduce the risk of stock price collapse for firms in polluting industries in the inspector areas compared to non-inspector areas. We also find that the effect of CEPI on firms' stock price crash risk compared to non-environmental inspector regions is mainly found in the sample of private firms and those with lower information transparency, and in the sample of non-national civilized cities and regions with weaker incentives for officials' promotion. Further analysis finds that CEPI reduce the risk of stock price crash for firms in polluting industries by reducing stock price bubbles. Finally, the action of the batches of CEPI, mainly the second, third and fourth batches, reduces the stock price crash risk of polluting industry firms in the region compared to non-environmental inspector regions.

Compared with the existing literature, the contribution of our study is mainly in the following three

aspects: first, we analyze the environmental information disclosure effect of the CEPI from the perspective of stock price crash risk. With the increased importance of environmental pollution control in China's capital market, has the increase in the intensity of government environmental regulations effectively enhanced the effect of environmental information disclosure? We provide empirical evidence for the above question from the perspective of stock price collapse risk. Second, we enrich the research related to mandatory environmental information disclosure. The existing literature has focused on firms' environmental disclosure effects through environmental reports (Gray et al., 2001), annual and independent reports (Guthrie et al., 2008), social responsibility reports (Lu and Abeysekera, 2014), press conferences and corporate meetings (Zeghal and Ahmed, 1990), etc. We instead focus on the disclosure effects of CEPI. This expands the studies related to mandatory environmental information disclosure. Third, we assess the environmental governance effects of CEPI, and provide policy recommendations for the subsequent promotion of CEPI.

II. Policy Background, Literature and Hypotheses

1. Policy Background

In July 2015, the Environmental Protection Inspection Program (Pilot) was introduced and the Chinese central government established an environmental protection inspection mechanism. The first round of CEPI was then carried out in batches (pilot, first batch, second batch, third batch and fourth batch) in 31 provinces, cities and regions across the country. Unlike previous environmental policies, the CEPI have the characteristic of monitoring both “enterprises” and “local governments”. This means that the CEPI are no

longer looking for a short-lived “political blue sky”, but rather sustainable development. CEPI provide feedback to local governments on environmental pollution through mass monitoring, such as calls and letters. They then urge the local governments to rectify the situation by a deadline and make the local governments disclose the rectification plans and implementation status to the society. It can be said that the CEPI are a major innovation in China’s environmental regulatory system.

The CEPI inspected 31 provinces, cities and regions from January 4, 2016 to September 15, 2017.From January 4, 2016 to February 4, 2016, a pilot CEPI was launched in Hebei Province. Since then, the environmental protection inspectors have taken 21 months to achieve full coverage of the country’s 31 provinces, cities and regions, with each batch geared toward the eastern, central and western regions. Each batch lasts about a month and involves 7 or 8 provinces, cities and regions. The whole inspection process is divided into three stages, each stage lasts about 10 days. In the first stage the inspection team talks with the provincial party committees, provincial governments and leaders of relevant departments and receives complaints from the public. The second stage investigates and verifies environmental problems by checking official documents and investigating pollution on the ground, and comes up with a list of environmental problems. The third stage speaks about the list of problems transferred to the local government, requiring it to rectify and feedback by a deadline. Pilot areas and four batches of environmental protection inspectors received a total of 99,783 cases reported by the public, shut down and rectified 82,081 enterprises, interviewed 17,601 relevant personnel, 17,707 people were held accountable, detained 1,543 people, and fined 1.306 billion yuan. Among them, the fines are not less than 100 million yuan in the

following regions: Shandong Province, Jiangsu Province, Zhejiang Province, Fujian Province and Guangdong Province. The region with the most fines is Zhejiang Province.

2. Literature review and hypothesis formulation

Existing research on CEPI is divided into four main parts. The first is to study the emission reduction effect of CEPI. In the theoretical model, Chong and Sun (2020) explored the emission reduction strategies of CEPI based on an evolutionary game theory model. In the empirical analysis, many scholars found that CEPI can improve environmental quality (Wu and Hu, 2019; Jia and Chen, 2019; He and Geng, 2020) and reduce pollutant emissions (Zhang et al., 2018). While Wu and Hu (2019) argue that the emission reduction effect of CEPI is not sustainable in the short term, Jia and Chen (2019) argue that this effect will not gradually diminish after regulation. Second, study the capital market response to the CEPI. Scholars have analyzed the effect of CEPI in terms of corporate stock value (Tian et al., 2019) and capital market response (Zeng et al., 2021), respectively. With the exception of Zhang et al. (2021), there is little literature examining the effect of CEPI' policies on the risk of stock price crash.

The existing literature analyzes the causes of stock price crash risk mainly at the firm level and at the management level, such as the shareholding of large shareholders (Boubaker et al., 2014), management and board ownership, board size and director independence (Andreou et al., 2016), board diversity in terms of gender, age, tenure and education (Jebran et al., 2020) and management overconfidence (Kim et al., 2016). From the available studies, it seems that information opacity is an important reason for the formation of stock price crash risk.

In recent years, scholars have begun to focus on the impact of information disclosure on stock price crash risk. Hutton et al. (2009) found that the lower the information transparency of financial statements, the higher the risk of corporate stock price crash. DeFond et al. (2015), on the other hand, found that changes in the financial reporting environment after the implementation of mandatory IFRS can reduces the stock price crash risk by increasing corporate financial information disclosure.

The most relevant literature to this paper is Zhang et al. (2021), which examines the impact of CEPI on the stock price crash risk and analyzes the potential mechanism from a corporate governance perspective, and we differ from Zhang et al. (2021) in three ways. The first is the difference in data structure. Zhang et al. (2021) use firm-year level panel data. The time span between batches of CEPI is known from the policy compendium section to be less than one year. Using yearly data may not clearly identify the implementation effects of each batch of CEPI. Therefore, we use firm-quarter level panel data for regression analysis. The second is the mechanism of the impact of the CEPI. We analyze the potential mechanisms by which CEPI affect the firm's stock price crash risk from the stock price bubble perspective. The third is the environmental governance effect of the CEPI. We systematically analyze the short-run and long-run environmental governance effects of the CEPI.

In summary, although the existing literature has analyzed the implementation effects of CEPI from multiple levels, it has not systematically analyzed the information disclosure effects of CEPI. Although the causes of stock price crash risk have been analyzed from the perspective of various types of information disclosure, there is little literature on the impact of environmental information disclosure on stock price

crash risk. In the studies related to environmental information disclosure, the way of corporate environmental information disclosure is mainly described qualitatively. Environmental information disclosure methods include corporate annual reports, environmental reports and social responsibility reports (Gray et al., 2001; Guthrie et al., 2008; Lu and Abeysekera, 2014). For enterprises, the above-mentioned environmental information disclosure methods are still somewhat autonomous and selective. The CEPI provides a good external environment for testing the effectiveness of mandatory environmental information disclosure.

We believe that CEPI will affect stock price crash risk in two ways. On the one hand, repeated and continuous inspectors can help reduce information asymmetry between the central government and local governments, and the random nature of inspectors can help eliminate local governments' sheltering behavior towards local polluters, increase the likelihood of environmental violations being exposed, and reduce the accumulation of negative information about firms, which in turn reduces the risk of firm stock price crashes. On the other hand, in terms of public participation to improve air pollution governance research, public participation can enhance environmental performance and environmental governance by enhancing the effectiveness of regulators' resource allocation (Dong et al., 2011) and the efficiency of government decision-making (North et al., 2014) (Wu et al., 2018; Li et al., 2018). The public participation feature of the CEPI is very obvious, as the CEPI collect and verify public complaint information online and make the inspector feedback results public, which significantly enhances public participation in environmental governance. This feature of the CEPI will further increase the disclosure of negative

corporate information, which in turn reduce the stock price crash risk. Since environmental violations mainly occur in the polluting industry sample, our study population is selected as polluting industry firms. Accordingly, we propose the hypothesis:

Hypothesis: CEPI reduce the firms' stock price crash risk in polluting industries.

III. Sample selection and study design

1. Measuring the stock price crash risk

Referring to Chen et al. (2001) and Hutton et al. (2009), we use *NCSKEW* and *DUVOL* to measure the firms' stock price crash risk. The specific calculations are as follows:

First, calculate the daily return at the firm level $W_{i,t} = \ln(1 + \varepsilon_{i,t})$

$$r_{i,t} = \alpha_0 + \alpha_1 r_{m.t-2} + \alpha_2 r_{m.t-1} + \alpha_3 r_{m.t} + \alpha_4 r_{m.t+1} + \alpha_5 r_{m.t+2} + \varepsilon_{i,t} \quad (1)$$

Second, calculate $NCSKEW$:

$$NCSKEW_{i,t} = -[n(n-1)^{\frac{3}{2}} \sum W_{i,t}^3]/[(n-1)(n-2)(\sum W_{i,t}^2)^{\frac{3}{2}}] \quad (2)$$

Where, *n* is the number of trading days in a quarter. A larger *NCSKEW* indicates a higher stock price crash risk.

Finally, calculate $DUVOL$:

$$DUVOL_{i,t} = \log\{[(n_{up}-1)\sum_{down} W_{i,t}^2]/[(n_{down}-1)\sum_{up} W_{i,t}^2]\} \quad (3)$$

Where, $n_{up}(n_{down})$ A is the number of trading days when the daily return of the stock is above (below) the mean of the current quarter's return. The sample is divided into a rising stock price group (up) and a falling stock price group ($down$) based on whether the stock's daily return is above the average return

of the current quarter. A larger value of $DUVOL$ indicates a higher stock price crash risk.

2. Research Design

For the selection of the study interval, we made the following adjustments. First, the CEPI first started on January 4, 2016 and ended on September 15, 2017. Although the environmental protection inspector look-back operation started in early 2018, each region started the inspector look-back only one year after the CEPI. Therefore, the inspector look-back policy will basically have no impact on our results. Accordingly, we selected a cut-off date of the end of 2019. Second, although the earliest CEPI began on January 4, 2016, the CEPI team was already stationed in Hebei Province at the end of 2015. We therefore set the start of the control group sample in 2014. Accordingly, we use the data of listed companies in polluting industry firms from 2014-2019 and apply the multi-period DID method to test the impact of the CEPI on the stock price crash risk of polluting industry firms:

$$y_{i,p,t} = \alpha + \beta DT_{p,t} + C_{i,p,t-1} + Disc_{p,t-1} + \lambda_i + \eta_t + \varepsilon_{i,p,t} \quad (4)$$

Which, $y_{i,p,t}$ denotes the risk of stock price crash for firm *i* in region *p* and period *t*. $DT_{p,t}$ denotes a policy dummy variable that takes the value of 1 when an area is launched as an inspector for the quarter and thereafter, and 0 for the others. The definition of polluting enterprises is based on the "List of Listed Enterprises for Environmental Verification Industry Classification and Management" published by the Ministry of Environmental Protection on June 24, 2008.

Following Chen et al. (2001) and Kim et al. (2011), We further control for lagged one-period indicators ($C_{i,p,t-1}$) that may affect the firms' stock price crash risk, includes: *Lev*, *Size*, *Roe*, *Sigma*, *Ret*, *Turnover*,

Top10 and lag *NCSKEW*.

Also, since district characteristics may affect whether the district is inspected or not. Therefore, to control for the endogeneity problem caused by omitting district characteristics, we control for a one-period lag of the district-level characteristic variables ($Disc_{p,t-1}$), includes: regional economic development indicators *LnGDP* and regional population indicators *LnPop*. We further control for firm fixed effects and time fixed effects.

3. Descriptive Statistics

We select data on listed companies in China's polluting industry firms from the first quarter of 2014 to the fourth quarter of 2019 to examine the impact of CEPI on the stock price crash risk of polluting industry firms. Among them, firm-level indicators are from the CSMAR database and regional-level data are from the EPS database. We screen the initial sample as follows: (1) in estimating the stock price crash risk indicators, exclude samples with less than 30 trading days per quarter; (2) exclude samples of financial industry enterprises; (3) exclude "ST" and "*ST" enterprises. The continuous variables were subjected to a 1% tailing process.

Descriptive statistics are shown in Table 1, where the mean values of *NCSKEW* and *DUVOL* are -0.4214 and -0.3268, respectively, and the median values are -0.4898 and -0.3805, respectively. This indicates that the stock price crash risk is at a low level. The mean value of the gearing ratio is 0.4073, with a minimum value of 0.0589 and a maximum value of 0.8788. This indicates that the leverage ratio of listed companies varies widely and is at a low level.

Table 1 Descriptive Statistics

Variables	N	Mean	Median	SD	Min	Max
NCSKEW	31846	-0.4214	-0.4898	0.9500	-2.6828	2.2270
DUVOL	31846	-0.3268	-0.3805	0.7707	-2.0490	1.7317
Lev	30235	0.4073	0.3981	0.1960	0.0589	0.8788
Size	30235	22.1822	21.9939	1.3043	19.9712	26.1102
Roe	30192	0.0401	0.0313	0.0605	-0.2179	0.2349
Sigma	31846	0.0289	0.0259	0.0131	0.0098	0.0757
Turnover	31279	-3.1219	-1.8133	42.7826	-166.7972	161.0072
Ret	31846	0.0008	0.0001	0.0043	-0.0081	0.0184
Top10	31816	59.7651	60.8200	14.7003	24.9800	91.4400
LnGDP	31846	21.7595	28.3886	8.9001	9.4091	29.8250
LnPop	31846	8.6152	8.6856	0.6106	6.5338	9.3366

IV. Empirical Results and Analysis

1. Analysis of basic results

We use a multi-period DID approach to test the impact of CEPI on the firms' stock price crash in polluting industries, and the regression results are shown in Table 2. Controlling for time fixed effects and firm fixed effects, the coefficients of *DT* are significantly negative after gradually adding firm- and region-level control variables. It indicates that the CEPI reduce the firms' stock price crash in polluting industries in the inspector areas compared to non-inspector areas. The results in columns (5)-(6) show that after the CEPI, the firms' stock price crash in the inspector areas is reduced by 0.0538 (*NCSKEW*) and 0.0454 (*DUVOL*) compared to the non-inspector areas, which is equivalent to 12.77% and 13.89% of the mean values of stock price crash risk indicators *NCSKEW* and *DUVOL*.

Table 2 CEPI and the Stock Price Crash Risk

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	*NCSKEW*	*DUVOL*	*NCSKEW*	*DUVOL*	*NCSKEW*	*DUVOL*
DT	-0.0319	-0.0224	-0.0538*	-0.0457*	-0.0538*	-0.0454*
	(-1.0446)	(-0.9124)	(-1.6751)	(-1.8448)	(-1.6770)	(-1.8337)
Firm-Controls	/	/	Yes	Yes	Yes	Yes
Region-Controls	/	/	/	/	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
N	31,845	31,845	26,567	26,567	26,567	26,567
Adjusted R^2	0.1011	0.1275	0.1317	0.1608	0.1316	0.1607

Note: t-values in parentheses, ***, **, * indicate significant at 1%, 5%, and 10% significant levels, respectively.

A prerequisite for the unbiased results of the difference in difference estimation is that the parallel

trend hypothesis is satisfied between the control and experimental groups, i.e., the control and control groups share a common trend of change prior to the event. To test whether the baseline regression satisfies the common trend test, we include the interaction term between the dummy variable and the policy variable at each time point in the regression. And if the coefficient of the interaction term before the inspector is not significant, it indicates that the parallel trend holds. The regression model as follows:

$$y_{i,p,t} = \alpha + \sum_{\tau=-6}^{12} \beta_\tau DT_{p,t-\tau} + C_{i,p,t-1} + Disc_{p,t-1} + \lambda_i + \eta_t + \varepsilon_{i,p,t} \quad (5)$$

Which, DT is a dummy variable, takes 1 if province *p* has an environmental inspector at time *t*-*τ*, and 0 otherwise. β_0 is the effect of the environmental protection inspector in the current period, β_{-1} to β_{-6} is the effect of the environmental inspector before 1-6 periods, β_1 to β_{12} is the effect of the environmental protection inspector after 1-12 periods, and β_1 to β_{12} is the dynamic effect of the inspector over time. If the coefficients of β_{-1} to β_{-6} are close to 0 and the coefficients of β_1 to β_{12} are different from 0, it indicates that the parallel trend test hypothesis is valid. The results of the parallel trend test in Figure 1 show that the coefficients of β_{-2} to β_{-6} are not statistically significantly different from 0, and the coefficients of β_1 to β_{12} are negative and statistically significantly smaller than 0. The parallel trend hypothesis is valid.

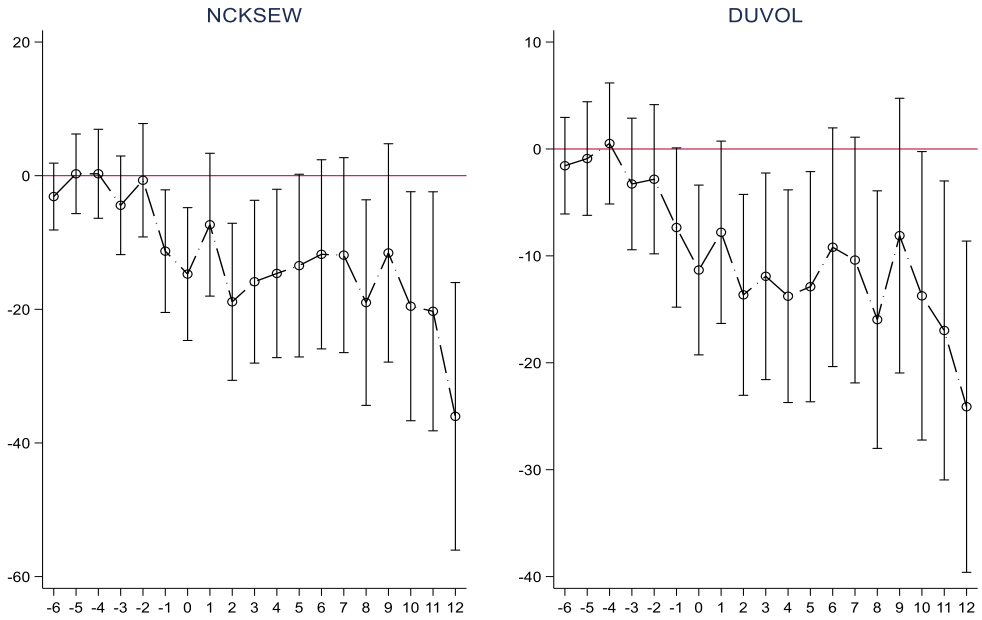

Figure 1 Parallel trend test

Note: We plotted Figure 1 by extracting the estimated coefficients from the regression shown in equation (5) with 90% confidence intervals.

2.Robust Test

(1) Excluding special samples.

First, the CEPI may exert unprecedented environmental regulatory pressure on enterprises in the inspected areas. Enterprises may have relocated due to the inspector pressure. Accordingly, we exclude the sample of enterprises that changed their business address between January 1, 2016 and December 31, 2017 from the regression, where the data on business address change are from the WIND database.

Second, the presence of estimated disturbances from other important environmental policies is tested. Since the de-capacity policy in 2016 and 2017 may have a significant impact on the relevant enterprises, the regression is conducted after excluding the sample of enterprises within the sample that belong to the de-capacity focus industries. the de-capacity focus industries released in 2016 and 2017 include six

industries: steel, coal, cement, shipbuilding, electrolytic aluminum, and glass, and we adopt the CITIC Securities industry classification criteria to exclude these six-industry enterprise sample.

The regression results of the above robustness test are shown in Table 3. Columns (1)-(2) are the regression results excluding the sample of corporate address changes. Columns (3)-(4) are the results of the regressions excluding the de-capacity samples. The coefficient of *DT* is significantly negative, which is consistent with the regression results in the main results.

Table 3 Excluding special samples

Variables	(1) *NCSKEW*	(2) *DUVOL*	(3) *NCSKEW*	(4) *DUVOL*
DT	-0.0588*	-0.0451*	-0.0488	-0.0465*
	(-1.7588)	(-1.7494)	(-1.4308)	(-1.7710)
All Controls	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes
N	24,828	24,828	24,261	24,261
Adjusted R^2	0.1307	0.1591	0.1338	0.1643

(2) Exclusion of spillover effects.

The CEPI divide the treatment and control groups based on geographical boundaries. Due to policy externalities, spillover effects may occur between treatment and control groups. That is, CEPI may affect the neighboring control group provinces, which violates the independence between treatment and control groups. Accordingly, we refer to Clarke (2017) to test the policy effects of CEPI after excluding spillover effects. The Spillover-Robust DID method is constructed, and the model is set as follows:

$$y_{i,p,t} = \alpha + \varphi_1 DT_{p,t} + \varphi_2 Close_{p,t} + C_{i,p,t-1} + Disc_{p,t-1} + \lambda_i + \eta_t + \varepsilon_{i,p,t} \quad (6)$$

Where, $Close_{p,t}$ denotes the nearest neighbor treatment group effect. If region p has CEPI in quarter t, its neighboring regions are set to 1 in quarter t and thereafter, and the rest are set to 0. The remaining variables are defined in the same way as in equation (4). Since CEPI is a one-time inspector mechanism,

there is no spillover effect for any of the regions that have been inspected, so none of the inspected regions are set as adjacent regions. The test results of the spillover effect of the CEPI are shown in Table 4, the DT coefficient is significantly negative and the Close coefficient is not significant, indicating that there is no spillover effect of the CEPI on neighboring areas.

Table 4 Exclusion of spillover effects

Variables	(1) *NCSKEW*	(2) *DUVOL*	(3) *NCSKEW*	(4) *DUVOL*	(5) *NCSKEW*	(6) *DUVOL*
DT	-0.0311	-0.0252	-0.0525	-0.0488*	-0.0529	-0.0487*
	(-1.0037)	(-1.0133)	(-1.6090)	(-1.9410)	(-1.6166)	(-1.9310)
Close	0.0051	-0.0162	0.0067	-0.0158	0.0045	-0.0164
	(0.2175)	(-0.8576)	(0.2710)	(-0.7951)	(0.1669)	(-0.7536)
Firm-Controls	/	/	Yes	Yes	Yes	Yes
Region-Controls	/	/	/	/	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
N	31,845	31,845	26,567	26,567	26,567	26,567
Adjusted R^2	0.1011	0.1275	0.1316	0.1608	0.1316	0.1607

(3) Substitution of stock price crash risk indicators.

We use *NCSKEW* and *DUVOL* as explanatory variables in the main text. To avoid estimation bias introduced by the selection of the explanatory variables. We refer to Callen and Fang (2015) and use whether stock returns are downward or upward (*Crash*) to measure stock price crash risk. The regression results are shown in column (1) of Table 5, and after replacing the indicators, the regression results are still consistent with the main results.

(4) Placebo test.

To test the randomness of the timing of the implementation of the CEPI, we conduct a placebo test for the time of the occurrence of the policy antecedently. If the coefficient of *DT* remains significantly negative in the results for one period ahead and two periods ahead, indicates that there are non-CEPI factors driving the change in stock price crash risk, not just the effect of the CEPI. The placebo test results are shown in

300 columns (2)-(5) of Table 5, the coefficient of *DT* is not significant, ruling out any interference in our results

301 from some of the non-CEPI factors or potentially unpredictable factors.

302 Table 5 Other robustness tests

Variables	(1) *Crash*	(2) *NCSKEW*	(3) *DUVOL*	(4) *NCSKEW*	(5) *DUVOL*
DT	-0.0019* (-1.6577)	-0.0022 (-0.0699)	-0.0105 (-0.4309)	-0.0355 (-1.1089)	-0.0197 (-0.8058)
All Controls	Yes	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes	Yes
N	26,567	25,546	25,546	23,636	23,636
Adjusted R^2	0.9177	0.1341	0.1641	0.1400	0.1689

303

304 **3. Heterogeneity test**

305 (1) Corporate heterogeneity test.

306 Compared with state-owned enterprises, private enterprises have fewer agency problems among

307 themselves, and managers' interests are relatively consistent with those of the company. Therefore, when

308 negative information appears in a company, managers will also hide negative information out of personal

309 interest. Negative environmental information disclosure can reduce managers' opportunistic behavior,

310 reduce negative information hiding, and thus reduce the risk of stock price crash. Accordingly, we

311 empirically analyze whether the dampening effect of CEPI on stock price crash risk is more significant

312 among private firms. The regression results of the firm heterogeneity test are shown in Table 6. The

313 coefficient of *DT* is significantly negative in the private enterprise sample in columns (1)-(4) and

314 insignificant in the state-owned enterprise sample. This indicates that the CEPI reduce the stock price crash

315 risk by increasing the disclosure of negative environmental information of private firms in the inspected

316 areas compared to non-environmental inspector areas, and this effect is not significant in the SOE sample,

317 reflecting to some extent the sheltering of SOEs by the local government.

In addition to this, to further test the differences between groups. We used Bootstrap method to calculate empirical p-values for the differences between groups in the sample by firm nature. A random sample of 300 times was set. The results of the test are shown in Table 6, and the coefficients between groups show significant differences.

Table 6 Corporate heterogeneity test

	(1)	(2)	(3)	(4)
	SOE	Non-SOE	SOE	Non-SOE
Variables	*NCSKEW*	*NCSKEW*	*DUVOL*	*DUVOL*
DT	0.0087	-0.0825*	-0.0023	-0.0691**
	(0.1626)	(-1.8799)	(-0.0560)	(-2.0130)
All Controls	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes
N	9,374	14,394	9,374	14,394
Adjusted R^2	0.1452	0.1344	0.1726	0.1664
Empirical p-values	0.007		0.017	

(2) Information transparency and disclosure quality heterogeneity test.

Kim and Zhang (2014) show that the lower the transparency of the firm, the stronger the manager's incentive to hide bad news. Based on this logic, for firms with low transparency of financial information and poor quality of information disclosure, the more managers hide bad news, the higher stock price crash risk of the firm. The CEPI have increased the disclosure of negative environmental information of firms in the inspected areas by increasing environmental supervision. For firms with low transparency, CEPI can disclose more environmental information. The theoretical effect of CEPI on stock price crash risk reduction is more effective in the sample with lower information transparency and poorer disclosure quality.

Based on the above analysis, we empirically test the mechanism of the role of information transparency and information disclosure quality in the stock price crash risk by CEPI. First, we refer to Hutton et al. (2009), which uses the sum of the absolute values of firms' surplus management in the

previous three years to measure the information transparency of firms, and a larger value indicates a lower information transparency of firms. We divide the 2014 corporate information transparency indicators into a lower corporate transparency sample and a higher transparency sample based on the median of the 2014 corporate information transparency indicators. Second, we further examine the results of heterogeneity in the quality of corporate information disclosure. We use the Shenzhen Stock Exchange's rating of information disclosure quality of listed companies to measure the quality of corporate information disclosure, and its assessment results are divided into four levels: excellent, good, qualified and unqualified. If the assessment result in 2014 is excellent or good, it is classified as a higher disclosure quality sample and takes the value of 1. If the assessment result in 2014 is qualified or unqualified, it is classified as a lower disclosure quality sample and takes the value of 0.

The regression results of the sub-firm transparency heterogeneity test are shown in columns (1)-(4) of Table 7. The coefficient of *DT* is significantly negative in the low-transparency sample and insignificant in the high-transparency sample. It indicates that the CEPI mainly reduce the firms' stock price crash risk in low-transparency polluting industries in the region compared to non-inspector regions. The regression results of the heterogeneity test of information disclosure quality are shown in columns (5)-(8) of Table 7, where the coefficient of *DT* is significantly negative in the low disclosure quality sample and insignificant in the high disclosure quality sample. It indicates that the higher information asymmetry, the more significant inhibitory effect of the CEPI on the stock price crash risk. To further test the differences between groups, we calculated empirical p-values for the differences between sub-sample groups using the

Bootstrap method, setting a random sample of 300 times. The results of the test are shown in Table 7, where the between-group coefficients of the core explanatory variables all show significant differences.

Table 7 Information transparency and disclosure quality heterogeneity test

Variables	(1) *NCSKEW*	(2) *NCSKEW*	(3) *DUVOL*	(4) *DUVOL*	(5) *NCSKEW*	(6) *NCSKEW*	(7) *DUVOL*	(8) *DUVOL*
DT	-0.0962**	-0.0043	-0.0851***	0.0016	-0.1408***	0.0078	-0.1136***	-0.0033
	(-2.2828)	(-0.0868)	(-2.5815)	(0.0417)	(-2.7270)	(0.1685)	(-2.9051)	(-0.0922)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	15,239	11,328	15,239	11,328	10,016	12,347	10,016	12,347
Adjusted R^2	0.1395	0.1233	0.1701	0.1508	0.1653	0.0928	0.2009	0.1089
Empirical p-values	0.000		0.000		0.007		0.000	

(3) Officials' promotion incentives heterogeneity test.

Although the central government in China maintains its political authority in environmental planning, the most basic implementation decisions and responsibilities have been assigned to local governments, and an environmental decentralization mechanism exists (Zheng, 2007). Previous studies have shown that the official promotion of local officials is linked to the level of regional economic development (Li and Zhou, 2005; Yao and Zhang, 2015), but the goals of the central and local governments in environmental protection are often inconsistent. Local governments have weak incentives to strengthen local enforcement efforts (Van Rooij, 2006) and sometimes provide false environmental data in response to central government environmental assessment requirements (Tian et al., 2020). Unlike previous environmental policies, CEPI are able to monitor local governments by mobilizing the public and include the results in the assessment and appointment of government officials. Thus, CEPI have the characteristic of monitoring local governments. Zhang et al. (2018) show that direct central regulation can reduce information asymmetry between central and local governments. Xie and Yong (2020) also show that under the deterrent effect of CEPI, political connections are no longer an effective way for polluters to circumvent strict environmental

372 regulation. We therefore expect the mitigating effect of CEPI on stock price crash risk to be more
373 pronounced under higher official promotion incentives.

374 Accordingly, we test the heterogeneous effect of officials' promotion incentives in the CEPI. We use
375 the following method to define promotion incentive indicators. First, define Remaining Political Age (*RPA*)
376 as the difference between an official's age at the time of taking office and the legal retirement age. The
377 retirement age is set to be, 65 for men and 60 for women. Secondly, the future political promotion space of
378 the officials is defined as the distance between the political level (*LE*) of their current position and the
379 highest official level. Finally, Politics Promotion (*PP*) was calculated with *PP=RPA/(5-LE)*. After that,
380 according to the median of official promotion incentive index in 2014 divided them into a larger sample of
381 official promotion incentive and a smaller sample, the results of official promotion heterogeneity test are
382 shown in Table 8, the coefficients of *DT* for high official promotion incentive samples in columns (1)-(4)
383 are basically significant negative, and the coefficients of *DT* for low official promotion incentive samples
384 are not significant, indicating that the higher the official promotion incentive, the more significant effect of
385 CEPI.

386 To further test the differences between groups, we calculated the empirical p-values of the differences
387 between sub-sample groups using the Bootstrap method, setting a random sample of 300 times, and the test
388 results are shown in Table 8, where the coefficients of the core explanatory variables (*DT*) show significant
389 differences between groups.

390 Table 8 Officials' promotion incentives heterogeneity test

Variables	(1) *NCSKEW*	(2) *NCSKEW*	(3) *DUVOL*	(4) *DUVOL*
DT	-0.1237***	0.0060	-0.1065***	-0.0061

	(-2.7718)	(0.1128)	(-3.0612)	(-0.1532)
All Controls	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes
N	12,602	13,965	12,602	13,965
Adjusted R^2	0.1340	0.1295	0.1659	0.1568
Empirical p-values	0.000		0.000	

4. Mechanism Analysis

We refer to Dass et al. (2008) to test whether CEPI reduce the stock price crash risk by reducing stock price bubbles. First, we use the price-to-book ratio (*PB*) and price-to-sales ratio (*PS*) to indicate the size of the stock price bubble of listed companies. The larger the value of PB/PS, the larger the stock price bubble. Second, the sample is sorted by *PB/PS* from smallest to largest and divided equally into four groups, and the fourth group of stocks is defined as bubble stocks. The dummy variables *PBDummy* and *PSDummy* are defined, and the bubble stocks take the value of 1, the rest take the value of 0. The regression results are shown in Table 9, and the coefficient of *DT* is significantly negative, indicating that the CEPI reduces the corporate stock price bubble.

Table 9 Mechanism Analysis

	(1)	(2)	(3)	(4)
Variables	*PB*	*PS*	*PBDummy*	*PSDummy*
DT	-0.7730	-1.0982**	-0.0141	-0.0176**
	(-1.1110)	(-2.0018)	(-1.5500)	(-2.1892)
All Controls	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes
N	27,129	27,129	27,129	27,129
Adjusted R^2	0.2980	0.4534	0.5695	0.6909

V. Further Analysis

1. The batches of CEPI effect test

Considering that the CEPI are environmental policies that gradually expand in scope in batches, the environmental protection inspectors of the previous batch may have certain warning and learning effects on the next batch. Theoretically, CEPI should deepen continuously in each batch. Accordingly, we test the stock price crash risk effect of CEPI in batches, and the results of the batch wise regressions are shown in Table 10. The results in columns (5)-(6) show that the coefficients of *DT*Batch 2*, *DT*Batch 3* and

*DT*Batch 4* are significantly negative, and the coefficients of *DT*Pilot* and *DT*Batch 1* are not significant, indicating that among the batches of environmental protection inspectors, the effect of pilot areas and the first batch of CEPI is poorer, and the second, third and fourth batches of CEPI have more significant effects. Moreover, by comparing the coefficients of *DT* for each batch in columns (5) and (6), it is found that the effect of CEPI is increasing from the pilot batch to the third batch as the policy of CEPI continues to progress, as shown by the regression coefficients of -0.0418>-0.0499>-0.0572>-0.0574 in column (5) and - 0.0199>-0.0274>-0.0502>-0.0562, where the inspection effect of the fourth batch of CEPI is slightly lower than that of the second and third batches.

Table 10 The batches of CEPI effect test

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	*NCSKEW*	*DUVOL*	*NCSKEW*	*DUVOL*	*NCSKEW*	*DUVOL*
DT Pilot*	-0.0072	-0.0063	-0.0390	-0.0157	-0.0418	-0.0199
	(-0.0901)	(-0.0918)	(-0.4658)	(-0.2234)	(-0.4934)	(-0.2796)
DT Batch 1*	-0.0416	-0.0079	-0.0522	-0.0278	-0.0499	-0.0274
	(-1.1099)	(-0.2605)	(-1.3308)	(-0.9022)	(-1.2514)	(-0.8754)
DT Batch 2*	-0.0416	-0.0347	-0.0579	-0.0522*	-0.0572	-0.0502*
	(-1.2012)	(-1.2459)	(-1.5971)	(-1.8433)	(-1.5643)	(-1.7567)
DT Batch 3*	-0.0344	-0.0360	-0.0559	-0.0544	-0.0574	-0.0562*
	(-0.8598)	(-1.1227)	(-1.3065)	(-1.6363)	(-1.3246)	(-1.6700)
DT Batch 4*	-0.0206	-0.0155	-0.0513	-0.0498*	-0.0527	-0.0500*
	(-0.5853)	(-0.5506)	(-1.3495)	(-1.7094)	(-1.3768)	(-1.7054)
Firm-Controls	/	/	Yes	Yes	Yes	Yes
Region- Controls	/	/	/	/	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
N	31,845	31,845	26,567	26,567	26,567	26,567
Adjusted R^2	0.1010	0.1274	0.1315	0.1607	0.1314	0.1607

2. The environmental governance effect of CEPI

The objectives of CEPI include restraining the environmental violations of non-compliant enterprises and increasing their environmental governance investment. Accordingly, we examine the impact of CEPI on long-term corporate governance investment and short-term emission reductions at the firm level. We examine the regional environmental governance effects of CEPI at the regional level.

We test the governance effects of CEPI at the enterprise level. First, we test the impact of CEPI on the long-term governance investment of enterprises. We test the impact of CEPI on corporate emissions costs

by collecting and collating data on corporate emissions costs from disclosure reports of listed companies, and using the logged corporate emissions cost indicator *Pay*. We test the impact of CEPI on corporate water and air pollution treatment expenditures by using corporate air treatment input and water treatment input data from the CSMAR database. Among them, the indicators of corporate pollution control inputs are obtained from CSMAR's environmental research database of listed companies, and the logged water pollution input costs *Water_Pay* and logged air pollution input costs *Gas_Pay* indicators are used as corporate pollution control input indicators. The regression results in columns (1)-(3) of Table 11 show that CEPI significantly increase the expenditure of corporate emission fees and increase corporate air pollution treatment inputs, but not water pollution treatment inputs. Second, we test the impact of CEPI on firms' short-term emission reduction. In particular, information on wastewater (*Water*) and exhaust gas (*SO2* and *COD*) emissions are obtained from the CSMAR database. The regression results in columns (4)-(6) of Table 11 show that the CEPI significantly reduce SO2 and COD polluting gas emissions of enterprises in polluting industries, and do not reduce wastewater emissions. Third, we examine the impact of CEPI on firms' green patent applications. Among them, green patent application data are obtained from the CNRDS database, including green invention patent application (*GreenInv*) and green utility model patent application (*GreenNew*) data. The regression results in columns (7)-(8) of Table 11 show that CEPI significantly increase the number of green invention patent and green utility model patent applications and enhance the R&D level of enterprises in polluting industries.

The regression results in Table 11 show that there is heterogeneity in the environmental governance effects of the CEPI. For water pollution control, the effect of CEPI on the long-term treatment investment and short-term emission reduction of enterprises is not significant. For air pollution treatment, the effect of CEPI on long-term treatment investment and short-term emission reduction by enterprises is significant. It shows that CEPI in the treatment of air pollution does play a certain governance effect, there are certain defects in the treatment of water pollution. Therefore, the government should further deepen the supervision intensity of CEPI in water pollution management.

Table 11 The environmental governance effect of CEPI

Variables	(1) *Pay*	(2) *Water_Pay*	(3) *Gas_Pay*	(4) *Water*	(5) *Gas_SO2*	(6) *Gas_COD*	(7) *GreenInv*	(8) *GreenNew*
DT	0.1095**	-0.0175	0.0229	0.0017	-0.0149**	-0.0166**	0.4133***	0.1694***

	(2.0194)	(-0.6351)	(1.4592)	(0.2096)	(-2.0901)	(-2.1767)	(3.1986)	(2.6800)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time and Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	26,567	27,129	27,129	26,567	26,567	26,567	26,567	26,567
Adjusted R^2	0.8200	0.3079	0.3786	0.4087	0.4874	0.4451	0.8803	0.8042

We examined the effectiveness of CEPI' governance at the regional level. We collected emission data such as industrial wastewater emissions, industrial SO2 emissions, and industrial soot emissions, as well as patent data such as the number of patent applications, the number of patents granted, and the number of invention patents granted, for each region by compiling the China City Statistical Yearbook. After that, we use the logarithmic regional emission indicators *Ind_Water/ Ind_SO2/ Ind_Dust*, and the indicators *Inv_App/ Inv_Aut/ Inv_Ant* of patent applications (total number of invention patents and utility model patents, number of invention patents and utility model patents) to test the impact of CEPI on regional pollutant emissions. The results in columns (1)-(3) in Table 12 demonstrate that CEPI significantly reduce regional wastewater and exhaust emissions. The results in columns (4)-(6) show that CEPI significantly increase the number of patent applications and grants in the region. The results show that the environmental treatment effect of CEPI in the region is significant.

Table 12 The regional governance effect of CEPI

Variables	(1) *Ind_Water*	(2) *Ind_SO2*	(3) *Ind_Dust*	(4) *Inv_App*	(5) *Inv_Aut*	(6) *Inv_Ant*
DT	-8.0142***	-5.3746***	-5.3376***	0.8270***	0.7849***	0.6709***
	(-10.9503)	(-11.5324)	(-11.5155)	(3.6281)	(3.6140)	(3.5989)
Region- Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-FE	Yes	Yes	Yes	Yes	Yes	Yes
N	744	744	744	744	744	744
Adjusted R^2	0.5626	0.5516	0.5417	0.5206	0.5209	0.5229

VI. Conclusions

China's rapid economic development has also brought about many ecological and environmental problems, and the enforcement effects of existing environmental policies still need further evaluation. In

this paper, we use the environmental policy of CEPI as a quasi-natural experiment and combine data from listed companies in polluting industries. From the perspective of environmental information disclosure, we use difference in difference estimation to examine whether CEPI mitigate firms' stock price crash risk by reducing the hoarding of negative information.

This paper finds that CEPI reduce the firms' stock price crash risk in polluting industries in the region compared to non-inspector regions. The disclosure effect of CEPI is mainly found in the sample of private firms, firms with lower information transparency and disclosure quality, and firms in non-national civilized cities and regions with stronger incentives for officials to be promoted. This may be due to the fact that CEPI enhance the disclosure of negative environmental information in such samples, which inhibits the hoarding of negative information and thus reduces the stock price crash risk. CEPI mainly reduce the firms' stock price crash risk in polluting industries by reducing the stock price bubble. Among the batches of CEPI, the second, third and fourth batches had better information disclosure effects, and the effect of each batch of inspectors gradually deepened. CEPI differ in the effectiveness of water pollution and air pollution treatment. CEPI increased the long-term treatment investment and short-term emission reduction effect of polluting industry enterprises in air pollution treatment, and the effect of inspectors in water pollution treatment was not significant.

This paper examines the enforcement effectiveness of CEPI from the perspective of environmental information disclosure, using CEPI as a quasi-natural experiment. It not only helps to clarify the effectiveness of environmental governance after the enactment of environmental policies, but also extends

the research on CEPI. It also deepens the regulators' knowledge and understanding of the linkages between the central government, local governments, and local enterprises. And thus, has important practical implications for the promulgation and implementation of environmental policies.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent to Publish

Not applicable.

Authors Contributions

Mengyao Wen designed the experimental protocol, carried out the experiments, wrote the manuscript, revised the manuscript, read and approved the manuscript.

Funding

Not applicable.

Competing Interests

The authors declare no competing interests.

Availability of data and materials

Not applicable.

References

Andreou, P. C., C. Antoniou, J. Horton, and C. Louca. Corporate Governance and Firm-specific Stock Price Crashes[J]. *European Financial Management*, 2016, 22(5):916-956.

Boubaker, S., H. Mansali, and H. Rjiba. Large Controlling Shareholders and Stock Price Synchronicity[J]. *Journal of Banking and Finance*, 2014, 40(3):80-96.

513 Callen, J. L., and X. Fang. Religion and Stock Price Crash Risk[J]. *Journal of Financial and*
514 *Quantitative Analysis*, 2015, 50(1-2):69-195.
515 Chen, J., H. Hong, and J. Stein. Forecasting Crashes: Trading Volume, Past Returns and Conditional
516 Skewness in Stock Prices[J]. *Journal of Financial Economics*, 2001, 61(3):345–381.
517 Chong, D., and N. Sun. Explore Emission Reduction Strategy and Evolutionary Mechanism under
518 Central Environmental Protection Inspection System for Multi-agent based on Evolutionary Game
519 Theory[J]. *Computer Communications*, 2020,156(3):77-90.
520 Clarke, D. Estimating Difference-in-Differences in the Presence of Spillovers[J]. MPRA Paper 81604,
521 2017.
522 Dass, N., M. Massa, and R. Patgiri. Mutual Funds and Bubbles: The Surprising Role of Contractual
523 Incentives[J]. *The Review of Financial Studies*, 2008, 21(1):51-99.
524 Defond, M., M. Hung, S. Li, and Y. Li. Does Mandatory IFRS Adoption Affect Crash Risk[J]?
525 *Accounting Review*, 2015, 90(1):265-299.
526 Dong, Y., M. Ishikawa, X. Liu, and S. Hamori. The Determinants of Citizen Complaints on
527 Environmental Pollution: An Empirical Study from China[J]. *Journal of Cleaner Production*, 2011, 19(12):
528 1306-1314.
529 Gray, R., M. Javad, D.M. Power, and C.D. Sinclair. Social and Environmental Disclosure and
530 Corporate Characteristics: A Research Note and Extension[J]. *Journal of Business Finance and Accounting*,
531 2001, 28(3-4):327-356.

Guthrie, J., S. Cuganesan, and L. Ward. Industry Specific Social and Environmental Reporting: The Australian Food and Beverage Industry[J]. *In Accounting Forum*, 2008, 32(1):1-15.

He, L-Y., and M-M. Geng. Can Chinese Central Government Inspection on Environmental Protection Improve Air Quality[J]? *Atmosphere*, 2020, 11(10):1025.

Hong, H., and J.C. Stein. Differences of Opinion, Short-Sales Constraints, and Market Crashes[J]. *Review of Financial Studies*, 2003,16(2):487- 525.

Hutton, A.P., A.J. Marcus, and H. Tehranian. Opaque Financial Reports, R2, and Crash Risk[J]. *Journal of Financial Economics*, 2009, 94(1): 67-86.

Jebran, K., S. Chen, and R. Zhang. Board Diversity and Stock Price Crash Risk[J]. *Research in International Business and Finance*, 2020,51(1):101122.1-101122.19.

Jia, K., and S. Chen. Could Campaign-style Enforcement Improve Environmental Performance? Evidence from China's Central Environmental Protection Inspection[J]. *Journal of Environmental Management*, 2019, 245:282–290.

Kim, J., Y. Li, and K. Zhang. Corporate Tax Avoidance and Stock Price Crash Risk: Firm-Level Analysis[J]. *Journal of Financial Economics*, 2011,100(3):639-662.

Kim, J. B., and L. Zhang. Financial Reporting Opacity and Expected Crash Risk: Evidence from Implied Volatility Smirks[J]. *Contemporary Accounting Research*, 2014, 31(3):851-875.

Kim, J., and L. Zhang. Accounting Conservatism and Stock Price Crash Risk: Firm-level Evidence[J]. *Contemporary Accounting Research*, 2016,33(1):412-441.

Li, G., Q. He, S. Shao, and J. Cao. Environmental Non-governmental Organizations and Urban Environmental Governance: Evidence from China[J]. *Journal of Environmental Management*, 2018, 206(1):1296-1307.

Li, H., and L. Zhou. Political Turnover and Economic Performance: The Incentive Role of Personnel Control in China[J]. *Journal of Public Economics*, 2005,89(9):1743-1762.

Lu, Y., and I. Abeysekera. Stakeholders' Power, Corporate Characteristics, and Social and Environmental Disclosure: Evidence from China[J]. *Journal of Cleaner Production*, 2014,64(2): 426-436.

North, D.W., P.C. Stern, T. Webler, and P. Field. Public and Stakeholder Participation for Managing and Reducing the Risks of Shale Gas Development[J]. *Environmental Science and Technology*, 2014, 48(15): 8388-8396.

Tian, M., G. Xu, and L. Zhang. Does Environmental Inspection Led by Central Government Undermine Chinese Heavy-polluting Firms' Stock Value? The Buffer Role of Political Connection[J]. *Journal of Cleaner Production*, 2019, 236(11): 117695.

Tian, Z., Y. Tian, Y. Chen, and S. Shao. The Economic Consequences of Environmental Regulation in China: From a Perspective of the Environmental Protection Admonishing Talk Policy[J]. *Business Strategy and the Environment*, 2020, 29(4): 1723-1733.

Van Rooij, B. Implementation of Chinese Environmental Law: Regular Enforcement and Political Campaigns[J]. *Development and Change*, 2006, 37(1): 57–74.

Wu, J., M. Xu, and P. Zhang. The Impacts of Governmental Performance Assessment Policy and

570 Citizen Participation on Improving Environmental Performance across Chinese Provinces[J]. *Journal of*
571 *Cleaner Production*, 2018, 184(5):227-238.

572 Wu, R., and P. Hu. Does the "Miracle Drug" of Environmental Governance Really Improve Air
573 Quality? Evidence from China's System of Central Environmental Protection Inspections[J]. *International*
574 *Journal of Environmental Research and Public Health*, 2019, 16(5):850.

575 Xie, T., and W. Yong. The Stock Market's Reaction to Strict Environmental Inspection: Evidence from
576 Heavily Polluting Listed Companies in China[J]. *International Journal of Banking and Finance*, 2020,
577 15(2): 95-117.

578 Zeghal, D., and S.A. Ahmed. Comparison of Social Responsibility Information Disclosure Media
579 Used by Canadian Firms[J]. *Accounting, Auditing and Accountability Journal*, 1990,3(1):38-53.

580 Zeng, H., B. Dong, Q. Zhou, and Y. Jin. The Capital Market Reaction to Central Environmental
581 Protection Inspection: Evidence from China[J]. *Journal of Cleaner Production*, 2021, 279(1):123486.

582 Zhang, B., X. Chen, and H. Guo. Does Central Supervision Enhance Local Environmental
583 Enforcement? Quasi-experimental Evidence from China[J]. *Journal of Public Economics*. 2018, 164(8):
584 70–90.

585 Zhang, X., J. Tan, and K.C. Chan. Environmental Law Enforcement as External Monitoring: Evidence
586 from the Impact of An Environmental Inspection Program on Firm-level Stock Price Crash Risk[J].
587 *International Review of Economics & Finance*, 2021, 71(1):21-31.