CONTAMINATED HEART: DOES AIR POLLUTION HARM BUSINESS ETHICS? EVIDENCE FROM EARNINGS MANIPULATION

ABSTRACT

We investigate whether air pollution harms business ethics from the perspective of earnings manipulation, which exerts a real effect on the economy and social welfare. Using a large sample and a comprehensive air quality index in China, we find that firms located in cities with more severe air pollution exhibit higher levels of discretionary accruals and are more likely to restate their financial statements, consistent with exposure to air pollution leading to more earnings manipulation. We further provide causal evidence using propensity score matching and a discontinuity regression design (RDD) exploiting the Qinling Mountain - Huai River Heating Policy Line, which exogenously leads to more air pollution to cities located immediately north of the Line but not those in the south. Our findings are robust to controlling for weather conditions and alternative samples and measures of air pollution and earnings manipulation. Overall, this study unveils how the ecological environment shapes business ethics.

Keywords: air pollution; business ethics; earnings manipulation.

CONTAMINATED HEART: DOES AIR POLLUTION HARM BUSINESS ETHICS? EVIDENCE FROM EARNINGS MANIPULATION

1. INTRODUCTION

We investigate whether and how air pollution—a natural environment factor—induces earnings management.[1] Earnings management is a purposeful intervention in the financial reporting process by management to influence stakeholders about the true performance of the firm, or to alter contractual outcomes that depend on financial reports (Healy and Wahlen 1999). It is therefore widely regarded as unethical in the accounting and business ethics literature (Bruns and Merchant 1990; Choi and Pae 2011; Greenfield et al. 2008; Huang et al. 2008; Labelle et al. 2010). Accounting and business ethics researchers have shown great interest in understanding the determinants of earnings manipulation (e.g., Ahluwalia et al. 2018; Buchholz et al. forthcoming; Degeorge et al. 1999; Healy 1985; Hegde and Zhou 2019; Jha 2019; Martin et al. 2014; Miller and Xu 2019). These determinants documented in prior literature can be largely classified into two types: (1) economic factors, and (2) psychosocial factors. In terms of economic factors, compensation and capital market incentives are the most prevailing incentives behind earnings management (Graham et al. 2005). With regard to psychosocial factors, recent studies document that earnings management is increasing with aggression, narcissism, pressure, and overconfidence, and decreasing with integrity, religiosity, and managerial ability (e.g., Demerjian et al. 2013; Feng et al. 2010; Ge et al. 2011; Ham et al. 2017; McGuire et al. 2012; Schrand and Zechman 2012).

In this paper, we go beyond psychosocial and economic factors and explore air pollution as a determinant of earnings manipulation. Air pollution is one of the greatest challenges faced

[1] We use "earnings manipulation" and "earnings management" interchangeably in this paper.

by business and society. According to the World Health Organization (WHO, 2016) and the World Bank (2016), air pollution killed an estimated three million people worldwide in 2012 and cost about $5.11 trillion in welfare losses from pollution-related fatal illness in 2013. As noted by Cho et al. (2006), a fundamental business ethics issue in the academic literature relates to the role of business in responsibly managing the natural environment (Newton 2005), and the extant literature largely focuses on how ethical considerations shape firms' attitude, policy, or strategy towards firms' environmental performance. Importantly, this stream of research generally finds that firms that are poorer environmental performers tend to engage in more unethical "greenwashing" activities that aim to deceive shareholders and other stakeholders by disclosing misleading information about their environmental performance (Cho and Patten 2007; Cho et al. 2018; Patten 2002). For instance, Cho et al. (2006) report that firms that pollute more spent more on political contribution to limit their environmental responsibilities and engage in more misrepresentation of their environmental performance. Cho et al. (2008; 2018) document that document that greenwashing firms and those that lobby for anti-environmental laws and regulations (hence unethical) are the worst polluters. Relatedly, Zhang et al. (2020) find that CEO hubris is positively associated with firm pollution. While these results from prior research can be, and have been, interpreted as driven by a lack of ethical climate or ethical culture in the organization (i.e., ethics is the root cause), given the recent findings in psychology that exposure to air pollution can induce unethical behavior (e.g., Bondy et al. 2020; Lu et al. 2018), a possible alternative is that being exposed to air pollution causes firms to engage in unethical reporting (i.e., ethics is the outcome). Hence, studying whether and how air pollution induces an unethical business practice enriches our insights of the interplay between business ethics and air pollution.

We predict managers who are exposed to higher levels of air pollution to engage in more earnings manipulation. Firstly, the decision to manipulate earnings involves the trade-off between the benefits and the costs of earnings manipulation (Armstrong et al. 2013). While the benefits are often imminent, the costs (e.g., possible restatements, enforcement actions, litigations, and dismissals) can be in a distant future (Karpoff et al. 2008). Prior psychology research finds consistent evidence that exposure to air pollution leads to hormonal changes that raise change intertemporal decision-making and lead individuals to focus on the present (Li et al. 2017; Riis-Vestergaard et al. 2018). In this regard, based on the earnings management literature which documents that managers focusing more on the present are more likely to manipulate earnings (Haga et al. 2018; Kim et al. 2017), we expect earnings management to increase with air pollution.

Secondly, prior studies find that air pollution elevates anxiety, aggressiveness and disregard for the law (Burkhardt et al. 2019; Lu et al. 2018). Evidence provided by Ge et al. (2011) suggests that aggressive CFOs are associated with higher levels of discretionary accruals and higher likelihood of accounting misstatements. Davidson et al. (2015) find that CEOs who have less regard for the law are more likely to commit material financial misstatements. Following this line of reasoning, we can expect that managers exposed to higher levels of air pollution engage in more earnings management.

Furthermore, prior research (Dong et al. forthcoming; Hanna and Oliva 2015; Lavy et al. 2014; Li et al. forthcoming; Rotton 1983; Zhang et al. 2018; Zivin and Neidell 2012) finds that individuals exposed to higher levels of air pollution experienced decreases in cognitive performance and productivity, which are important for managers to perform (Kaplan et al. 2012; Wai and Rindermann 2015). To the extent that managers deliver worse performance as their cognitive performance and productivity decrease when exposed to air pollution, they are more likely to resort to earnings manipulation to inflate firm performance (Burgstahler and Dichev 1997; Degeorge et al. 1999; Graham et al. 2005; Healy 1985).

Finally, prior studies show that observing others committing an unethical act increases observers' likelihood to commit the same or even different unethical behaviors (Ayal and Gino 2011; Gino and Ariely 2016; Gino et al. 2009; Keizer et al. 2008). The presence of some highly polluting firms in a specific area can increase the level of air pollution locally. In this regard, given prior findings that highly polluting firms tend to engage in misreporting of their environmental performance (Cho and Patten 2007; Cho et al. 2006; 2018; Patten, 2002), the observation of such dishonesty by managers of other local firms could lead them to engage in other unethical financial reporting behavior. Hence, we expect to see more unethical behaviors in area with elevated air pollution.

We empirically test this prediction using a large sample and a comprehensive air quality index in China.[2] We find that firms located in cities with more severe air pollution report higher level discretionary accruals and are more likely to restate their financial statements, suggesting that managers exposed to higher levels of air pollution engage in more earnings manipulation. We also employ a discontinuity regression design (RDD) exploiting the *Qinling Mountain - Huai River* Heating Policy which creates an exogenous shock to air pollution unrelated to firm activities, and the results support the causal interpretation that exposure to higher levels of air pollution leads to more earnings manipulation. Our results are robust to using alterative measures of earnings management as well as alternative sample and model specifications.

[2] The combination of overall severe air pollution with substantial variation in air pollution levels across regions in China provides a powerful setting to test our prediction. See Section 3.1 for more details.

Our study contributes to the literature in several ways. We add insights to the research that examines the interconnectedness of business ethics and air pollution. Extant research seeks to understand how business ethics underscore firm policy and action towards environmental protection in general and air pollution in particular (e.g., Cho et al. 2006; Zhang et al. 2020). Our research provides novel evidence that business ethics can be influenced by firms' exposure to air pollution, and thus depict a more complete picture of such interplay. We also enrich studies on the *external* determinants of unethical financial reporting by extending them beyond legal regimes and country-level investor protection (Leuz et al. 2003), national culture (Chen et al. 2018a), and religiosity (Kanagaretnam et al. 2015; McGuire et al. 2012). To the best of our knowledge, little is known about the effect of air pollution on managers engaging in unethical reporting behaviors. Given that unethical financial reporting has a profound and adverse effect on the value of, and public trust in, business (Almer et al. 2008; Farber 2005), our research has relevant implications for shareholders and other market participants. Last but not least, whereas early studies of air pollution focus on people's physical and psychological states (e.g., Pope 2000; Power et al. 2015) as well as labor supply and productivity (e.g., Chang et al. 2014; Hanna and Oliva 2015; Zivin and Neidell 2012) from the perspective of health science and psychology, an emerging stream of literature examines the effect of air pollution on financial market participants such as fund managers and financial analysts (Dong et al. forthcoming; Li et al. forthcoming). Our study contributes to this emerging research by exploring the effect of air pollution on managers' unethical behaviors.

The remainder of our paper is structured as follows. Section 2 discusses the literature review and hypothesis development. The data, model, and variable definitions are presented in

Section 3. We present the main results in Section 4 and additional tests in Section 5. Section 6 concludes.

2. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

2.1 Earnings management

In this section, we review the relevant studies that examine economic incentives and personal psychology traits as determinants of earnings management.[3] One of the main streams within this research area examines the economic incentives of earnings management. Among these, compensation and capital market incentives are the most prevailing ones. For instance, Healy (1985) and Bergstresser and Philipon (2006) document that managers manipulate earnings upwards to increase their cash bonus and stock-based compensation. Degeorge et al. (1999) and Burgstahler and Dichev (1997) provide evidence consistent with earnings management being used to avoid missing earnings benchmarks and analyst forecasts. Graham et al. (2005) provide survey evidence consistent with compensation and market incentives being the two most prevailing motivation for earnings management. According to these studies, poor firm performance that fall short of a benchmark, such as bonus threshold or market expectation, is the common driver behind earnings management decision and practice. That is, managers are more likely to resolve to earnings management to boost earnings when the firm faces poor financial performance.[4]

[3] See, for instance, Dechow et al. (2010) and Bishop et al. (2017) for comprehensive reviews of the earnings management literature.
[4] Although poor performance is implicated as a determinant of earnings management in many prior studies, some research suggests that firms with good performance may also engage in earnings management. For instance, Healy (1985) find that managers engage in downward earnings management when their bonuses have reached the maximum due to good firm performance. While Harris and Bromiley (2007) find that bonuses have no impact on firms' financial misrepresentation, their results suggest that the probability of restatements is increasing in firm performance. We believe this alternative nonetheless works against us finding significant results. We thank an anonymous reviewer for leading us to this discussion.

Another stream of earnings management research examines how psychosocial factors explain cross-sectional variations in earnings management behaviors. For example, Bamber et al. (2010) capture the fixed effect of top management on voluntary corporate financial disclosure, which is explained by their observable demographic characteristics and personal backgrounds. By connecting signature size with narcissism which is found to be likely to result in unethical actions, Ham et al. (2017) provide evidence that CFO narcissism is associated with low-quality financial reporting processes (e.g., weaker internal control quality) and outcomes (more earnings management, less timely loss recognition, and higher probability of restatements). Similarly, Buchholz et al. (forthcoming) also document that highly narcissistic CEOs engage in higher levels of earnings management. Schrand and Zechman (2012) show that overconfident executives are more likely to exhibit an optimistic bias and thus are more likely to start down a slippery slope of growing intentional misstatements.

In this stream of the literature, our work relates to studies that explore the intertemporal nature of earnings management—with benefits of earnings management in the near future while costs in the distant future—to investigate how individual perceive or discount the future affect their decision to manipulate earnings. Kim et al. (2017) report that CEOs who speak languages that do not grammatically disassociate the future from the present are likely to perceive future negative consequences of earnings management to be more imminent and thus engage in less earnings management. Haga et al. (2018) argue that managers' decision to manipulate earnings depends on the trade-off in the present value of expected costs and benefits associated with earnings management, and document a positive association between discount rate and earnings management. Taken together, this line of research points to intertemporal consideration as a determinant of earnings management.

Furthermore, our work also relates to studies that examine executives' aggressiveness and disregard for the law. Davidson et al. (2015) find that CEOs with a legal record outside the workplace—which are symptoms of a relatively high disregard for the law—are more likely to commit material financial misstatements. Focusing on CFOs, Ge et al. (2011) find evidence suggesting that aggressive CFOs are associated with higher levels of discretionary accruals and higher likelihood of financial misstatements.

2.2 Consequences of air pollution

Early studies on the consequences of air pollution are mainly situated in the fields of medicine and psychology and explore whether and how pollution affects people's physical and psychological states. In terms of physical consequences, for instance, Pope (2000) finds that air pollution induces cardiopulmonary disease, transient increases in respiratory symptoms, and decreased lung function. Further, Beatty and Shimshack (2014) show that pollution exposure significantly increases non-infant children's respiratory problems. It is therefore not surprising that air pollution leads to greater mortality, as confirmed by a recent report from the WHO (2016). On the psychological side, early work by Rotton (1983) shows that malodor adversely influences evaluative and cognitive judgments, tolerance for frustration, and cognitive performance. Lercher et al. (1995) document that lower air quality is associated with participants' self-reported fatigue. Power et al. (2015) find that higher past exposure to particulate air pollution is associated with greater and more prevalent anxiety symptoms.

Recent research in this area has shifted to the real effect of air pollution on the specific behaviors of individuals (e.g., purchase, labor supply, and crimes) and/or performance (e.g., worker productivity and test scores). Several studies investigate the effect of air pollution on the participation and productivity of workers in certain industries and they generally find consistent results. Investigating the productivity of indoor workers at a pear-packing factory, Chang et al. (2014) find that an increase in PM2.5 outdoors led to a statistically and economically significant decrease in packing speed inside the factory. Considering the closure of a refinery in Mexico City as a natural experiment, Hanna and Oliva (2015) show that a 20% drop in SO_2 resulted in a 1.3-hour increase in hours worked the following week. Focusing on workers in two call centers in China, Chang et al. (2019) document that higher levels of air pollution decreased worker productivity, reducing the number of calls that workers complete each day. Consistent with these studies, Lavy et al. (2014) also find that pollution exposure reduces cognitive performance using standardized test scores among Israeli high school high-stakes tests. Using Chinese data, Dong et al. (forthcoming) and Li et al. (forthcoming) provide evidence that air pollution reduces analyst earnings forecasts and increases investors' disposition effect.

In addition, several studies explore whether and how air pollution induces violent crimes. Using studies linking pollution to aggression, Burkhardt et al. (2019) find that air pollution increased violent crime across the United States. Using data on a nine-year panel of 9,360 US cities and experimental data collected from American and Indian participants, Lu et al. (2018) document that a polluted environment can induce criminal and unethical behaviors (e.g., cheating) and show that anxiety can mediate this relation. Using air pollution data in London from 2004 to 2005, Bondy et al. (2020) provide evidence that elevated levels of air pollution have a positive and statistically significant impact on violent activities and economic crimes.

2.3 Hypothesis development

Based on the prior literature discussed above, we expect air pollution to increase unethical financial reporting behavior—directly, by influencing the intertemporal perception of earnings management costs as well as managerial aggression and disregard for the law, and indirectly, through its impact on firm financial performance. Figure 1 summarizes our main arguments pertaining to how air pollution *per se* influences earnings management.

[Insert Figure 1 here]

First, managers decide on the extent of earnings manipulation based on the trade-off between the benefits and costs of such practice (Armstrong et al. 2013). Whereas the benefits (e.g., bonuses based on meeting analyst forecasts) usually occur imminently after such acts, the potential costs (e.g., possible restatements, enforcement actions, litigations, and dismissals) may not occur until several years afterwards (Karpoff et al. 2008). Prior psychology research finds that air pollution exposure can trigger stress hormone changes (Li et al. 2017), which alter inter-temporal decision-making and lead individuals to focus more on the present (Bondy et al. 2020; Riis-Vestergaard et al. 2018). To the extent that managers who focus more on the present are more likely to manipulate earnings (Haga et al. 2018; Kim et al. 2017), we therefore predict that managers exposed to higher levels of air pollution would engage in more earnings management.

Second, previous studies show that air pollution elevates aggressiveness and disregard for the law (Bondy et al. 2020; Burkhardt et al. 2019) and induces anxiety (Lu et al. 2018), which can also lead to unethical behaviors through elevated aggressiveness (Kouchaki and Desai 2015). As reviewed above, prior research in accounting indicates that executives who are aggressive and have high disregard for the law are associated with higher levels of discretionary accruals and higher likelihood of financial misstatements (Davidson et al. 2015; Ge et al. 2011). This line of reasoning also leads us to predict that managers exposed to higher levels of air pollution engage in more earnings manipulation.

In addition, exposure to elevated air pollution has been found to reduce individuals' cognitive performance (Dong et al. forthcoming; Lavy et al. 2014; Li et al. forthcoming; Rotton

1983; Zhang et al. 2018) and productivity (Chang et al. 2019; Hanna and Oliva 2015; Zivin and Neidell 2012). Kaplan et al. (2012) and Wai and Rindermann (2015) find that the cognitive performance and productivity of managers matters for firm performance, suggesting that firms run by managers with worsened cognitive performance and productivity are more likely to deliver poor or unsatisfactory performance. Given that the main economic incentive of earnings management is to increase compensation or avoid missing analyst forecasts when firm performance is poor (Burgstahler and Dichev 1997; Degeorge et al. 1999; Graham et al. 2005; Healy 1985), we therefore also expect the exposure to air pollution to indirectly induce unethical financial reporting behavior.

In addition to what we argue above about how air pollution *per se* influences earnings management, prior studies show that managers of highly polluting firms tend to aggressively engage in "greenwashing" activities—misrepresenting their environment performance to stakeholders (e.g., Cho et al. 2006). Extant research suggests that individuals' unethicality can be influenced by their surrounding physical and social environments (Ayal and Gino 2011; Gino and Ariely 2016). For instance, Gino et al. (2009) examine whether exposure to dishonest behavior of others affects individuals' dishonesty. Under experimental conditions, they find that observing a dishonest act from an in-group peer increased participants' likelihood of acting unethically themselves. Furthermore, Keizer et al. (2008) show that when individuals observe that others violate a certain social norm or legitimate rule, they become more likely to violate *other* norms or rules. In this regard, as managers of highly polluting firms engage in unethical "greenwashing" activities, those of other local firms could become more likely to engage in other unethical behaviors. Taken all together, we hypothesize that:

H1: *Ceteris paribus, air pollution is positively associated with earnings manipulation*.

3. RESEARCH DESIGN

3.1 Sample selection and data source

We empirically test the prediction using air pollution data from China. Over the past several decades, China has witnessed rapid economic growth—which comes, however, with heavy costs, including high levels of air pollution. The Environmental Performance Index (EPI), published annually by the Yale Center for Environmental Law and Policy, ranks China as one of the most polluted economies in the world. Whereas the overall air pollution level is higher—China being a large country of diverse geographic conditions and industrial developments—there are significant variations in air pollution levels across Chinese cities. This combination of overall severe air pollution with substantial variation in air pollution across regions thus provides a powerful setting to test our prediction. Our initial sample consists of all Chinese public firms that issued A-shares on the Shenzhen or Shanghai Stock Exchanges between 2014 and 2017. Our primary data source for the study's financial information data is the China Securities Markets and Accounting Research Database (*CSMAR*). We obtain air pollution data from the Chinese Research Data Service (*CNRDS*), which collects daily air quality data for all prefecture-level cities in China. The data collected include the density of specific harmful gases, that is SO_2 (sulfur dioxide), NO_2 (nitrogen dioxide), CO (carbon monoxide), O_3 (ozone), particles (*PM2.5*, *PM10*), over the last 24 hours, and their composite index – the Air Quality Index (hereafter, AQI) – for which a higher value indicates worse air quality. The data on prefecture-level city GDP is from the China Entrepreneur Investment Club Database (*CEIC*).

The initial sample from *CSMAR* contains 12,068 firm-years over our sample period. We exclude 272 firm-years in financial industries due to their uniqueness of operations, the structure of their financial reporting and regulations, and we drop a further 246 observations due to missing data on air pollution (*AP*). After further excluding 1,025 and 1,017 observations missing data on discretionary accruals and the other variables, respectively, in our baseline model, we obtain a final sample of 9,508 firm-years as described in Panel A of Table 1. All of the continuous variables are winsorized at 1% and 99% to mitigate the effect of outliers. The industry distribution, which is shown in Panel B of Table 1, is generally consistent with the distribution of the *CSMAR* population.

[Insert Table 1 here]

3.2 Model specification and measures

We use two proxies—discretionary accruals and financial restatements—to capture earnings manipulation. Following prior studies in accounting and ethics (Hegde and Zhou 2019; Jha 2019; McGuire et al. 2012; Miller and Xu 2019), our first proxy is discretionary accruals estimated using a modified Jones model (Dechow et al. 1995).[5] As discussed in Dechow et al.'s (2010) review paper, the use of the Jones model and its modified versions has become the accepted methodology in accounting to capture managerial discretion in financial reporting. Specifically, we estimate the following model cross-sectionally by each industry-year with at least 10 observations. The industry is identified based on the China Securities Regulatory Commission (CSRC) 2001 industrial classification code.[6]

$$\frac{TA_{i,t}}{Asset_{i,t-1}} = \alpha_1 \frac{1}{Asset_{i,t-1}} + \alpha_2 \left(\frac{\triangle REV_{i,t}}{Asset_{i,t-1}} - \frac{\triangle AR_{i,t}}{Asset_{i,t-1}} \right) + \alpha_3 \frac{PPE_{i,t}}{Asset_{i,t-1}} + \varepsilon_{i,t}, \tag{1}$$

where $Asset_{i,t-1}$ equals total assets at the beginning of the year, $TA_{i,t}$ equals net income minus cash flow from operations, $\triangle REV_{i,t}$ is the change in sales revenues, $\triangle AR_{i,t}$ is the change in

[5] Our inference remains the same if we follow Kothari et al. (2005) or Dechow and Dichev (2002) to estimate discretionary accruals, or if we follow Chen et al. (2018b) and include explanatory variables of the modified Jones model as control variables in Eq (2) that we use for the hypothesis testing.
[6] See Table 1 Panel B for the industry classification scheme.

receivables, and $PPE_{i,t}$ is the net value of fixed assets. We then calculate our first proxy of earnings management, *DA*, as the absolute value of the residuals from the regression. Higher values of *DA* indicate high levels of earnings manipulation.

While discretionary accruals as a proxy for earnings management is widely used in the prior and recent literature, it is also subject to estimation errors. Therefore, we use financial restatement (*RESTATE*) as our second proxy for earnings management, in line with prior research (e.g., Ahluwalia et al. 2018; Harris and Bromiley 2007; Hoitash 2011; McGuire et al. 2012).[7]

To test our hypothesis, we build the following baseline model:

$$EM = \alpha_0 + \alpha_1 AP + \alpha_2 SOE + \alpha_3 SIZE + \alpha_4 BM + \alpha_5 ROA + \alpha_6 OCF + \alpha_7 LVE + \alpha_8 SEG + \alpha_9 AGE + \alpha_{10} LOSS + \alpha_{11} ST + \alpha_{12} OREC + \alpha_{13} CROSS + \alpha_{14} FSR + \alpha_{15} DUAL + \alpha_{16} BRD + \alpha_{17} IDR + \alpha_{18} BIG4 + \alpha_{19} GDP + \alpha_{20} MKT + City,\ Industry\ \&\ Year\ FE + \varepsilon, \quad (2)$$

where *EM* represents earnings manipulation, which is measured by two proxies: (1) discretionary accruals (*DA*); and (2) financial restatement (*RESTATE*). *AP* is variable of interest capturing air pollution. It is calculated as the mean value of the daily AQI in the city in which the firm is headquartered over the fiscal year[8] divided by 100, with a higher value indicating higher level of air pollution. We expect α_1 to be significantly positive if H1 holds.

Following prior literature (Chen et al. 2011; Chen et al. 2018a; Gul et al. 2013; Filip et al. 2020), we control for firm size (*SIZE*), growth opportunity (book-to-market ratio, *BM*), profitability (*ROA*), cash flows from operations (*OCF*), and financial leverage (*LEV*), as they correlate with incentives of earnings management as well as the accruals process. Furthermore, the nature of ownership (whether the enterprise is ultimately controlled by the State, or *SOE*) is included since the SOEs have less incentive to manage earnings than non-SOEs (e.g., Chen et al.

[7] We focus on the case of restatements that correct the overstated financial position or performance (Ahluwalia et al. 2018) and are not tax driven. Expanding to all restatements does not alter our inference.
[8] All Chinese firms have a fiscal year that runs from January 1 to December 31. Our results remain similar when we measure *AP* from January 1 to the date of financial statements issuance, as shown in Table 9.

2011). We include the number of subsidiaries (*SEG*) and the number of years after listing (*Age*) to control for the operation complexity, which could constrain earnings management. We also control for (1) *Loss* and special treatment warning (*ST*) as in China, a listed firm is specially treated by the stock exchanges (i.e., put on the delisting risk warning list) if it experiences two consecutive years loss, which strongly incentivize managers to avoid incurring losses; and (2) *OREC*, the intensity of other accounts receivable, as the ultimate owners in China can use other accounts receivables (e.g., loan to the entities owned by the ultimate owners) to extract resources from their owned public firms (e.g., Jiang et al. 2010) and mask their tunneling activities through earnings management. Given the effect of corporate governance in limiting earnings management, we include a set of corporate governance variables, namely the cross-listing status of the firm (*CROSS*), the percentage shares hold by the largest shareholder (*FSR*) that directly determines the extant of agency conflicts, CEO duality (*DUAL*), the size (*BRD*) and independence (*IDR*) of boards of directors. We also control for whether the firm is audited by Big4 auditors or not (*Big4*), given existing studies on the relation between audit quality and earnings management (e.g., Chen et al. 2011). Beyond firm-level characteristics, GDP growth (*GDP*), the degree of marketization of the province in which the firm is located (*MKT*), and city, industry, and year fixed effects are included to control for the effects of macro-economic, institutional and industrial environments as well as time trend.

4. MAIN RESULTS

Table 2 presents the descriptive statistics for the main variables. The first-quartile, median, and third-quartile values of *AP* are 0.650, 0.790, and 0.948, respectively, with a standard deviation of 0.221, which suggests that our sample has sufficient variance in air pollution. In our sample, 36.1% of the sample firms are state-owned and the other variables show reasonable degrees of variance in the sample.

[Insert Table 2 here]

Table 3 reports the results of the effect of air pollution on earnings manipulation. In the first two columns where the dependent variable is *D*A, the coefficient on *AP* is positive and statistically significant at 5%, suggesting that firms located in cities of higher levels of air pollutions have higher levels of discretionary accruals. In terms of the effect sizes, we note that the coefficient on *AP* is 0.097; thus, increasing *AP* from the first quartile (0.650) to third quartile (0.948) is associated with an increase in *DA* by 0.029, which is about 15% of the standard deviation of *DA*. Hence, the results are not only statistically significant, but also economic meaningful. For *RESTATE* in the last columns, the coefficient on *AP* is positive and significant at 5%, suggesting that the financial reports of firms in more polluted cities are more likely to contain significant misstatements that require subsequent restatements. These results support H1 that managers exposed to higher levels of air pollution manipulate earnings to a greater extent.

In terms of control variables, most are consistent with existing findings. As shown, SOEs are less likely to manipulate earnings, possibly because profits are not the targets as important as for non-SOEs (e.g., Chen et al. 2011); ST firms are more likely to manipulate earnings and to restate their financial reports due to their strong incentive to avoid warning of de-listing from the Stock Exchange if their losses remain; larger firms (*SIZE*), mature firms (*BM*), and firms with more cash flows (*OCF*), more subsidiaries (*SEG*), larger (*BRD*) and more independent (*IDR*) board of directors have higher earnings quality. It is interesting that the coefficient of *ROA* in the *DA* specification is positive while the one in the *RESTATE* specification is negative. Whereas prior studies generally find a positive relation between return on assets and discretionary accruals (e.g., Dechow et al. 1995; Lee et al. 2006; McGuire et al. 2012), the relation between return on assets and restatement is less conclusive, with some studies showing a positive relation (e.g., Harris & Bromiley 2007) and some showing a negative relation (Hoitash 2011; McGuire et al. 2012).

[Insert Table 3 here]

5. ADDITIONAL ANALYSES AND ROBUSTNESS TESTS

5.1 Additional analyses

5.1.1 Endogeneity

Our findings may be subject to two potential endogeneity issues; that is, (1) spurious regression results from the systematic differences between firms in highly polluted cities and the rest of firms, and (2) omitted correlated variables.

The first three columns in Panel A of Table 4 show that firms in more air-polluted cities are more likely to be SOEs (*SOE*), larger (*SIZE*), more mature (*BM*), and older (*AGE*), to experience losses (*LOSS*), to have more concentrated owners (*FSR*) and larger board of directors (*BRD*), and more likely to be audited by high-quality auditors (*BIG4*) whereas having lower profitability (*ROA*), cash flows (*OCF*) and leverage (*LEV*), fewer subsidiaries (*SEG*), fewer independent directors (*IDR*), their chairman of the board of directors is less likely to be CEOs (*DUAL*), and the economic development (*GDP*) and marketization (*MKT*) in the regions where they locate lag behind their counterparts. These results point to systematic differences between firms in high air-pollution cities and other firms. To tackle this issue, we separate our sample into high vs low air pollution subsamples based on median *AP* and match each observation in the high air pollution subsample to an observation with the closest propensity score in the low air pollution subsample. To ensure covariate balance, we drop pairs in which the absolute difference in propensity score exceeds 0.01. The PSM procedure generates 2,987 pairs of observations. After matching, the differences between these two subsamples diminish, as shown in the last three columns in Panel A of Table 4. We then use this matched sample to rerun our baseline model and report the results in Panel B of Table 4. As shown in Table 4, the results are similar to those in Table 3 in statistical terms, but economically stronger, i.e., the coefficients on *AP* with *DA* and *RESTATE* as the dependent variables are 0.112 and 2.623, respectively, while the corresponding values in Table 3 are 0.097 and 1.774. Hence, it is unlikely that our findings are driven by the systematic differences between firms located in high vs low air pollution cities.

[Insert Table 4 here]

To mitigate the concern of omitted correlated variables, we employ discontinuity regression design (RDD) in Table 5. During the period 1950-1980, when China was a planning economy instead of a market economy, the Chinese government established free winter heating for homes and offices via the provision of free coal for fuel boilers as basic rights to areas located in northern China which is defined by the line formed by the *Qinling Mountain* and *Huai River*. This is known as the Heating Policy Line in China. The combustion of coal in boilers during the winter season is associated with emission of various air pollutants, and is a major contributor to air pollution that is exogenous to firm activities and earnings management. In this regard, the Heating Policy Line provides a good setting to employ RDD.

We follow Chen et al. (2013), Ebenstein et al. (2017), and Li et al. (forthcoming) and adopt RDD to test whether firms' earnings manipulation behavior exhibits discontinuous changes around the Heating Policy Line. First, we conduct a non-parametric test in Panel A of Table 5. We define *North* as the difference between the latitude of city where the firm is located and the latitude of the Heating Policy Line (a positive value of *North* means that the city is located north of the Heating Policy Line, and negative for the opposite). Results show that the coefficient on *North* is 0.041 in the DA specification and 0.022 in the *RESTATE* specification, both significant at 10%, suggesting that firms located north of the Heating Policy Line and thus exposed to exogenously higher level of air pollution have greater levels of earnings manipulation, consistent with our main findings. Second, we conduct and report a local parameter OLS regression test in Panel B of Table 5. The results remain similar. Finally, we visualize the discontinuity in Figure 2 where discretionary accruals (*DA*) and financial restatement (*RESTATE*) appear significantly discontinuous for firms located in close proximity to the Heating Policy Line. Taken together, findings based on the RDD design are consistent with our main findings, providing strong support to our prediction that exposure to higher levels of air pollution leads to more earnings manipulation.

[Insert Figure 2 here]

[Insert Table 5 here]

5.1.2 Controlling for weather conditions

Weather conditions can influence, or be associated with, the level of air pollution. For instance, Chang et al. (2018) note that air pollution tends to be lower on rainy days, when precipitation serves to wash away airborne pollutants. Hence, we conduct a test by additionally controlling for weather conditions to address the issue of a potential omitted variable. Following Chang et al. (2018), we control for the city-level weather variables within the same time window. We consider temperature (*HOTDAY*), wind (*WINDDAY*), and rain (*BADDAY*), and their composite measure, *WEA_SCORE* estimated by the principal component analysis in Table 6. *HOTDAY* measures the number of days that the temperature is above 37^{o}C or below 0^{o}C divided by the number of time-window days; *WINDDAY* measures the number of days that the wind power is greater than level 3 divided by the number of time-window days; *BADDAY* measures the number of rainy or snowy days divided by the number of time-window days. Either when we control for *HOTDAY*, *WINDDAY*, and *BADDAY*, or when *WEA_SCORE* is included, the coefficients of *AP* in all of columns are significantly positive, indicating that our main findings are not driven by weather conditions influencing, or associated with, the levels of air pollution.

[Insert Table 6 here]

5.1.3 Moderating effect of air pollution

In this additional analysis, we test for the presence of city contextual effects or "cross-level interactions" with city air pollution, to examine whether air pollution interacts with firm variables to moderate the relation between firm characteristics and earnings manipulation. To do so, we first remove the between-subject components from the firm characteristics, leaving only within-subject components. We next interact each of these within-subject components with AP, and add these interaction terms to Equation (2).

We observe from the regression results (untabulated) that, in both DA and RESTATE specifications, while the coefficients on AP remain significant, none of the interaction term is consistently significant across these two specifications. Hence, the results do not support the presence of city contextual effects.

5.2 Robustness tests

5.2.1 Alternative samples

In this section, we use alternative samples to further gauge the robustness of our main findings:

Exclude the non-concentrated firms. In the previous analyses, we measure air pollution (*AP*) for the city where the firm's headquarters are located, which is the same as that of its parent company. However, firms often have many subsidiaries and branches in different cities or even in different provinces and countries. If our conjecture holds true, we should observe that our main findings remain unchanged when we restrict the sample to groups for which the parent company makes up the majority of the consolidated company. Therefore, in the first two columns of Table 7, we exclude observations for which the parent company's total assets are less than 50% of those in the consolidated company.[9] Results still show air pollution significantly affect earnings manipulation.

Focus on parent company. To further avoid the interference by subsidiaries and branches outside the city in which the parent company is located, we focus our analysis on parent companies in the third column of Table 7. DA^{parent} is estimated by the sample of parent companies. Results show that air pollution is significantly and positively associated with parent companies' discretionary accruals.[10]

Exclude firms in highly polluting industries. There exists one alternative explanation that our results are mostly driven by firms in highly polluting industries rather the city's air pollution. For instance, a chemical company located in a city with overall good air quality can emit pollutants that lead to low air quality in its factory and immediate surrounding area. Consequently, for firms operating in the polluting industries, citywide air pollution levels may not accurately reflect its local air pollution levels. We therefore restrict the sample by excluding observations from polluting industries,[11] and our results as reported in the last two columns of Table 7 remain unchanged.

---

[9] The results do not change when we exclude observations for which the parent company's total assets are less than 60%, 70%, 80%, and 90% of those of the consolidated company. For brevity, we do not tabulate these results, but they can be made available upon request.

[10] Due to the lack of data, we are not able to test for financial restatement of parent companies.

[11] The polluting industries include: B-Mining, C1-Textile, Clothing & Fur, C3-Papermaking & Printing, C4-Petroleum, Chemistry & Plastic, C6-Metal & Nonmetal, C8-Medicine & Biologics, D-Utilities.

[Insert Table 7 here]

5.2.2 Controlling for geographical distance between firms and regulators

It could be argued that financial restatement demonstrates not only that the accounting rules were broken, but also that the firm is caught. Consequently, given that the geographical location of the firm is associated with the level of air pollution—if the geographical location of the firm also affects the propensity of being caught—then our results based on financial restatements could be biased. Indeed, Kedia and Rajgopal (2011) document that firms that are located closer to the SEC are more likely to have financial restatements, consistent with the view that due to limited regulatory resources, the regulator is more likely to investigate geographically proximate firms.

We therefore reconduct the restatement analysis by additionally controlling for firm distance to CSRC (China Securities Regulatory Commission, the counterpart of the SEC in China). Results reported in Table 8 are consistent with our main findings, alleviating the concern that our restatement results are driven by firm geographical location rather than air pollution.

[Insert Table 8 here]

5.2.3 Alternative measures of air pollution

In the main tests, *AP* is calculated as the average score of the daily *AQI* of the firm's headquarter address over the period from January 1st to December 31st. We change the measures of *AP* in Table 9 in three different ways: (1) we extend the ending date of estimating period from December 31st to the date of issuance of financial reports (*AP_ANO*); (2) we use the firm's registered address (*AP_REG*) instead of the headquarters' address, and (3) we take the mean value of daily air pollution rating (from 0 to 5 indicating excellent air quality to heavy pollution) (*AP_RATE*). In all columns, results are statistically consistent with our main findings.

[Insert Table 9 here]

5.2.4 Alternative proxies of earnings management

Our main results are based on two widely used proxies: discretionary accruals estimated using a modified Jones model (Dechow et al. 1995) and accounting restatements. As such, the former is nonetheless developed and tailored to the US setting, which could be different from the Chinese setting that we use (e.g., accounting standards). The latter depends on not only the engagement in earnings manipulation but also its detection. Given concerns about Jones-type models in terms of measurement error (Kothari et al. 2005) and applicability in international settings (e.g., Ecker et al. 2013) and restatements suffering from Type II error (i.e., engagement in earnings manipulation but not detected), we seek to gauge the robustness of our results by using two alternative earnings management proxies.

First, we use the extent of non-core earnings (i.e., below-the-line items) as a proxy for earnings management. Prior studies (e.g., Chen and Yuan 2004) note that Chinese firms tend to manipulate the timing of transactions relating to below-the-line items to inflate earnings. Consistent with prior studies, we measure non-core earnings as the sum of investment net income, profits from other operations, and non-operating net income, divided by total assets (Gul et al. 2013). Results (untabulated) show that firms located in cities with higher levels of air pollution report higher levels of non-core earnings.

Second, we examine the propensity to meet or just beat zero earnings benchmark (Burgstahler and Dichev 1997), which is a widely used measure of earnings management and is independent of an estimation model (Dechow et al. 2010). In China, shares of listed firms that have two consecutive years of losses are designated as special treatment stocks (i.e., delist risk warning), and managers therefore have strong incentive to meet or beat zero earnings (Jiang and Wang 2008).

We find results (untabulated) consistent with firms located in cities with higher levels of air pollution being more likely to meet or just beat zero earnings benchmark, operationalized as earnings scaled by total assets between zero and one percent. Taken together, these two alternative measures provide additional confidence that our inference is not driven by the specific proxies we used in the main analysis.

6. CONCLUSION

The importance of environmental protection has become widely recognized, and many countries—including China—are determined to clean the air. However, our knowledge of the consequences of air pollution has been limited to physical and psychological health; it is far less clear whether and how air pollution induces ethical, economic, and social costs, which in turn affect social welfare. This study examined how air pollution affects business ethics from the perspective of earnings manipulation, which can increase social transactional costs and negatively impact capital allocation and social welfare.

We predicted that managers exposed to higher levels of air pollution would engage in more earnings management. We made this prediction from the following perspectives. First, we noted that psychology research shows that air pollution would increase the effective discount rate used by individuals in decision making (Bondy et al. 2020; Li et al. 2017; Riis-Vestergaard et al. 2018) and accounting research finds that earnings management is increasing with the discount rate used by managers to discount the costs of earnings management (e.g., Haga et al. 2018). Second, prior studies showed that air pollution leads to elevated aggression (Burkhardt et al. 2019; Lu et al. 2018). Finally, we noted that air pollution can lead to lower firm performance, as managers become less productive and suffer from lower cognitive performance after exposing to elevated air pollution (e.g., Chang et al. 2014; 2019; Dong et al. forthcoming; Hanna and Oliva 2015), and thus indirectly induce the use of earnings management to inflate firm performance.

Using a large sample and a comprehensive air quality index in China, we found that firms located in cities with more severe air pollution exhibit higher levels of discretionary accruals and are more likely to restate their financial statements, consistent with exposure to air pollution leading to more earnings manipulation. We further provide causal evidence using propensity score matching and a discontinuity regression design (RDD) exploiting the Qinling Mountain - Huai River Heating Policy Line, which exogenously leads to more air pollution to cities located immediately north of the Line. Our findings are robust to controlling for weather conditions and alternative samples and measures of air pollution and earnings management. Overall, this study unveils how the ecological environment shapes business ethics. Future research to explore the effects of air pollution on economic and social costs and the specific mechanisms that bridge air pollution and such costs is highly warranted.

REFERENCES

Ahluwalia, S., Ferrell, O. C., Ferrell, L., & Rittenburg, T. L. (2018). Sarbanes–Oxley Section 406 Code of Ethics for senior financial officers and firm behavior. *Journal of Business Ethics*, *151*(3), 693-705.

Almer, E. D., Gramling, A. A., & Kaplan, S. E. (2008). Impact of post-restatement actions taken by a firm on non-professional investors' credibility perceptions. *Journal of Business Ethics*, *80*(1), 61-76.

Armstrong, C. S., Larcker, D. F., Ormazabal, G., & Taylor, D. J. (2013). The relation between equity incentives and misreporting: The role of risk-taking incentives. *Journal of Financial Economics*, *109*(2), 327-350.

Ayal, S., & Gino, F. (2011). Honest rationales for dishonest behavior. In M. Mikulincer & P. R. Shaver (Eds.), *The social psychology of morality: Exploring the causes of good and evil*. Washington, DC: American Psychological Association.

Bamber, L. S., Jiang, J. X., & Wang, I. Y. (2010). What's my style? The influence of top managers on voluntary corporate financial disclosure. *The Accounting Review*, *85*(4), 1131–1162.

Beatty, T. K., & Shimshack, J. P. (2014). Air pollution and children's respiratory health: A cohort analysis. *Journal of Environmental Economics and Management*, *67*(1), 39-57.

Bergstresser, D., & Philippon, T. (2006). CEO incentives and earnings management. *Journal of Financial Economics*, *80*(3), 511-529.

Bishop, C., DeZoort, F., & Hermanson, D. (2017). Review of recent literature on pressure on CFOs to manipulate financial reports. *Journal of Forensic and Investigative Accounting*, *9*, 577-584.

Bondy, M., Roth, S., & Sager, L. (2020). Crime is in the air: The contemporaneous relationship between air pollution and crime. *Journal of the Association of Environmental and Resource Economists*, *7*(3), 555-585.

Bruns Jr., W. J., & Merchant, K. A. (1990). The dangerous morality of managing earnings. *Management Accounting*, *72*(2), 22-25.

Buchholz, F., Lopatta, K., & Maas, K. (forthcoming). The deliberate engagement of narcissistic CEOs in earnings management. *Journal of Business Ethics*.

Burgstahler, D., & Dichev, I. (1997). Earnings management to avoid earnings decreases and losses. *Journal of Accounting and Economics*, *24*(1), 99-126.

Burkhardt, J., Bayham, J., Wilson, A., Carter, E., Berman, J. D., O'Dell, K., Ford, B., Fischer, E. V., Pierce, J. R. (2019). The effect of pollution on crime: Evidence from data on particulate matter and ozone. *Journal of Environmental Economics and Management*, *98*, 102267.

Chang, T. Y., Zivin, J. G., Gross, T., & Neidell, M. (2014). Particulate pollution and the productivity of pear packers. *American Economic Journal: Economic Policy*, *8*(3), 141-169.

Chang, T. Y., Zivin, J. G., Gross, T., & Neidell, M. (2019). The effect of pollution on worker productivity: Evidence from Call Centre workers in China. *American Economic Journal: Applied Economics*, *11*(1), 151-172.

Chang, T. Y., Huang, W., & Wang Y. (2018). Something in the air: Pollution and the demand for health insurance. *Review of Economic Studies, 85*(3), 1609-1634.

Chen, H., Chen, J. Z., Lobo, G. J., & Wang, Y. (2011). Effects of audit quality on earnings management and cost of equity capital: Evidence from China. *Contemporary Accounting Research*, *28*(3), 892-925.

Chen, Y., Ebenstein, A., Greenstone, M., & Li, H. (2013). Evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River policy. *PNAS*, *110*(32): 12936-12941.

Chen, C., Gotti, G., Kang, T., & Wolfe, M. C. (2018a). Corporate codes of ethics, national culture, and earnings discretion: International evidence. *Journal of Business Ethics*, *151*(1), 141-163.

Chen, W., Hribar, P., & Melessa, S. (2018b). Incorrect inferences when using residuals as dependent variables. *Journal of Accounting Research*, *56*(3), 751-796.

Chen, K. C. W., & Yuan, H. (2004). Earnings management and capital resource allocation: Evidence from china's accounting-based regulation of rights issues. *The Accounting Review*, *79*(3), 645–665.

Cho, C. H., Chen, J. C., & Roberts, R. W. (2008). The politics of environmental disclosure regulation in the chemical and petroleum industries: Evidence from the Emergency Planning and Community Right-to-Know Act of 1986. *Critical Perspectives on Accounting*, *19*(4), 450-465.

Cho, C. H., Laine, M., Roberts, R. W., & Rodrigue, M. (2018). The frontstage and backstage of corporate sustainability reporting: Evidence from the Arctic National Wildlife Refuge Bill. *Journal of Business Ethics*, *152*(3), 865-886.

Cho, C. H., & Patten, D.M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, *32*(7-8), 639-647.

Cho, C. H., Patten, D. M., & Roberts, R. W. (2006). Corporate political strategy: An examination of the relation between political expenditures, environmental performance, and environmental disclosure. *Journal of Business Ethics*, *67*(2), 139–154.

Choi, T. H., & Pae. 2011. Business ethics and financial reporting quality: evidence from Korea. *Journal of Business Ethics*, *103*(3), 403-427.

Davidson, R., Dey, A., & Smith, A. (2015). Executives' "off-the-job" behavior, corporate culture, and financial reporting risk. *Journal of Financial Economics*, *117*(1), 5-28.

Dechow, P., Ge, W., & Schrand, C. (2010). Understanding earnings quality: A review of the proxies, their determinants and their consequences. *Journal of Accounting and Economics*, *50*(2), 344–401.

Dechow, P. M., Sloan, R. G., & Sweeney, A. P. (1995). Detecting earnings management. *The Accounting Review*, *70*(2), 193-225.

Dechow, P. M., & Dichev, I. D. (2002). The quality of accruals and earnings: The role of accrual estimation errors. *The Accounting Review*, *77*(Supplement), 35-59.

Degeorge, F., Patel, J., & Zeckhauser, R. (1999). Earnings management to exceed thresholds. *The Journal of Business*, *72*(1), 1-33.

Demerjian, P. R., Lev, B., Lewis, M. F., & McVay, S. E. (2013). Managerial ability and earnings quality. *The Accounting Review*, *88*(2), 463-498.

Dong, R., Fisman, R., Wang, Y., & Xu, N. (forthcoming). Air pollution, affect, and forecasting bias: Evidence from Chinese financial analysts. *Journal of Financial Economics*.

Ebenstein, A., Fan, M., Greenstone M., Hee, G., & Zhou, M. (2017). New evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River Policy. *PNAS*, *114* (39), 10384-10389.

Ecker, F., Francis, J., Olsson, P., & Schipper, K. (2013). Estimation sample selection for discretionary accruals models. *Journal of Accounting and Economics*, *56*(2-3), 190-211.

Farber, D. B. (2005). Restoring trust after fraud: Does corporate governance matter? *The Accounting Review*, *80*(2), 539-561.

Feng, M., Ge, W., Luo, S., & Shevlin, T. (2011). Why do CFOs become involved in material accounting manipulations? *Journal of Accounting and Economics*, *51*(1), 21-36.

Filip, A., Huang, Z., & Lui, D. (2020). Cross-listing and corporate malfeasance: Evidence from P-chip firms. *Journal of Corporate Finance*, *63*, 101232.

Ge, W., Matsumoto, D., & Zhang, J. (2011). Do CFOs have style? An empirical investigation of the effect of individual CFOs on accounting practices. *Contemporary Accounting Research*, *28*(4), 1141-1179.

Gino, F., & Ariely, D. (2016). Dishonesty explained: What leads moral people to act immorally. In A. G. Miller (Ed.), *The social psychology of good and evil* (2nd edition). New York: Guilford Press.

Gino, F., Ayal, S., & Ariely, D. (2009). Contagion and differentiation in unethical behavior: The effect of one bad apple on the barrel. *Psychological Science*, *20*(3), 393–398.

Graham, J., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, *40*(1-3), 3-73.

Greenfield, A. C., Norman, C. S., & Wier, B. (2008). The effect of ethical orientation and professional commitment on earnings management behavior. *Journal of Business Ethics*, *83*(3), 419-434.

Gul, F. A., Wu, D., & Yang, Z. (2013). Do individual auditors affect audit quality? Evidence from archival data. *The Accounting Review*, *88*(6), 1993-2023.

Haga, J., Ittonen, K., Tronnes, P. C., & Wong, L. (2018). Is earnings management sensitive to discount rates? *Journal of Accounting Literature*, *41*, 75-88.

Ham, C., Lang, M., Seybert, N., & Wang, S. 2017. CFO narcissism and financial reporting quality. *Journal of Accounting Research*, *55*(5), 1089-1135.

Hanna, R., & Oliva, P. (2015). The effect of pollution on labor supply: Evidence from a natural experiment in Mexico City. *Journal of Public Economics*, *122*(10), 65-79.

Harris, J., & Bromiley, P. (2007). Incentives to cheat: The influence of executive compensation and firm performance on financial misrepresentation. *Organization Science*, *18*(3), 350-367.

Healy, P. M. (1985). The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics*, *7*(1), 85-107.

Healy, P. M., & Wahlen, J. M. (1999). A review of the earnings management literature and its implications for standard setting. *Accounting Horizons*, *13*(4), 365-383.

Hegde, S., & Zhou, T. (2019). Predicting accounting misconduct: The role of firm-level investor optimism. *Journal of Business Ethics*, *160*(2), 535–562.

Hoitash, U. (2011). Should independent board members with social ties to management disqualify themselves from serving on the board? *Journal of Business Ethics*, *99*(3), 399–423.

Huang, P., Louwers, T., Moffitt, S., & Zhang, Y. (2008). Ethical management, corporate governance, and abnormal accruals, *Journal of Business Ethics*, *83*(3), 469-487.

Jha, A. (2019). Financial reports and social capital. *Journal of Business Ethics*, *155*(2), 567–596.

Jiang, G., Lee, C. M. C., & Yue, H. (2010). Tunneling through intercorporate loans: The China experience. *Journal of Financial Economics, 98*(1), 1-20.

Jiang, G., & Wang, H. (2008). Should earnings thresholds be used as delisting criteria in stock market? *Journal of Accounting and Public Policy, 27*(5), 409–419.

Kaplan, S. N., Klebanov, M. M., & Sorensen, M. (2012). Which CEO characteristics and abilities matter? *Journal of Finance*, *67*(3), 973-1007.

Karpoff, J. M., Lee, D. S., & Martin, G. S. (2008). The consequences to managers for financial misrepresentation. *Journal of Financial Economics*, *88*(2), 193-215.

Kedia, S., & Rajgopal, S. (2011). Do the SEC's enforcement preferences affect corporate misconduct? *Journal of Accounting and Economics*, *51*(3), 259-278.

Keizer, K., Lindenberg, S., & Steg, L. (2008). The spreading of disorder. *Science, 322*(5908), 1681–1685.

Kim, J., Kim, Y., & Zhou, J. (2017). Languages and earnings management. *Journal of Accounting and Economics*, *63*(2), 288–306.

Kothari, S. P., Leone, A. J., & Wasley, C. E. (2005). Performance matched discretionary accrual measures. *Journal of Accounting and Economics*, *39*(1), 163-197.

Kouchaki, M., & Desai, S. D. (2015). Anxious, threatened, and also unethical: How anxiety makes individuals feel threatened and commit unethical acts. *Journal of Applied Psychology*, *100*(2), 360-375.

Labelle, R., Gargouri, R. M., & Francoeur, C. (2010). Ethics, diversity management, and financial reporting quality. *Journal of Business Ethics*, *93*(2), 335-353.

Lavy, V., Ebenstein, A., & Roth, S. (2014). The impact of short-term exposure to ambient air pollution on cognitive performance and human capital formation. *NBER Working Paper No. 20468*.

Lee, C.-W., Li, L., & Yue, H. (2006). Performance, growth and earnings management. *Review of Accounting Studies*, *11*(2/3), 305–334.

Lercher, P., Schmitzberger, R., & Kofler, W. (1995). Perceived traffic air pollution, associated behavior and health in an alpine area. *Science of the Total Environment*, *169*(1-3), 71-74.

Leuz, C., Nanda, D., & Wysocki, P. D. (2003). Earnings management and investor protection: an international comparison. *Journal of Financial Economics,* 69(3), 505-527.

Li, J., Massa, M., Zhang, H., & Zhang, J. (forthcoming). Air pollution, behavioral bias, and the disposition effect in China. *Journal of Financial Economics*.

Li, H., Cai, J., Chen, R., Zhao, Z., Ying, Z., Wang, L., Chen, J., Hao, K., Kinney, P., Chen, H., & Kan, H. (2017). Particulate matter exposure and stress hormone levels: A randomized, double-blind, crossover trial of air purification. *Circulation, 136*(7), 618–27.

Lu, J. G., Lee, J. J., Gino, F., & Galinsky, A. D. (2018). Polluted morality: Air pollution predicts criminal activity and unethical behavior. *Psychological Science*, *29*(3), 340-355.

Martin, G., Campbell, J. T., & Gomez-Mejia, L. (2014). Family control, socioemotional wealth and earnings management in publicly traded firms. *Journal of Business Ethics*, *133*(3), 453-469.

McGuire, S. T., Omer, T. C., & Sharp, N. Y. (2012). The impact of religion on financial reporting irregularities. *The Accounting Review*, *87*(2), 645-673.

Miller, D., & Xu, X. (2019). MBA CEOs, short-term management and performance. *Journal of Business Ethics*, *154*(2), 285-300.

Newton, L. (2005). *Business ethics and the natural environment*. Oxford: Blackwell Publishing.

Patten, D. M. (2002). The relation between environmental performance and environmental disclosure: A research note. *Accounting, Organizations and Society, 27*(8), 763–773.

Pope, C. A. (2000). Epidemiology of fine particulate air pollution and human health: Biologic mechanisms and who's at risk? *Environmental Health Perspectives*, *108*(4), 713-723.

Power, M. C., Kioumourtzoglou, M. A., Hart, J. E., Okereke, O. I., Laden, F., & Weisskopf, M. G. (2015). The relation between past exposure to fine particulate air pollution and prevalent anxiety: Observational cohort study. *British Medical Journal, 350.*

Riis-Vestergaard, M. I, van Ast, V., Cornelisse, S., Joëls, M, & Haushofer, J. (2018). The effect of hydrocortisone administration on intertemporal choice. *Psychoneuroendocrinology, 88*, 173-82.

Rotton, J. (1983). Affective and cognitive consequences of malodorous pollution. *Basic and Applied Social Psychology*, *4*(2), 171-191.

Schrand, C. M., & Zechman, S. L. C. (2012). Executive overconfidence and the slippery slope to financial misreporting. *Journal of Accounting and Economics, 52*(1-2), 311-329.

Wai, J., & H. Rindermann. (2015). The path and performance of a company leader: A historical examination of the education and cognitive ability of Fortune 500 CEOs. *Intelligence*, *53*, 102-107.

World Bank. (2016). The cost of air pollution: Strengthening the economic case for action. World Bank Group.

World Health Organization (WHO). (2016). Ambient air pollution: A global assessment of exposure and burden of disease. *Available at*: http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1

Zhang, X., Chen, X., & Zhang X. (2018). The impact of exposure to air pollution on cognitive performance. *PNAS*, *115*(37), 9193-9197.

Zhang, L., Ren, S., Chen, X., Li, D., & Yin, D. (2020). CEO hubris and firm pollution: State and market contingencies in a transitional economy. *Journal of Business Ethics*, *161*, 459-478.

Zivin, J. G., & Neidell M. (2012). The impact of pollution on worker productivity. *American Economic Review 102*(7), 3652-367.

Figure 1: Hypothesized links between air pollution *per se* and earnings management

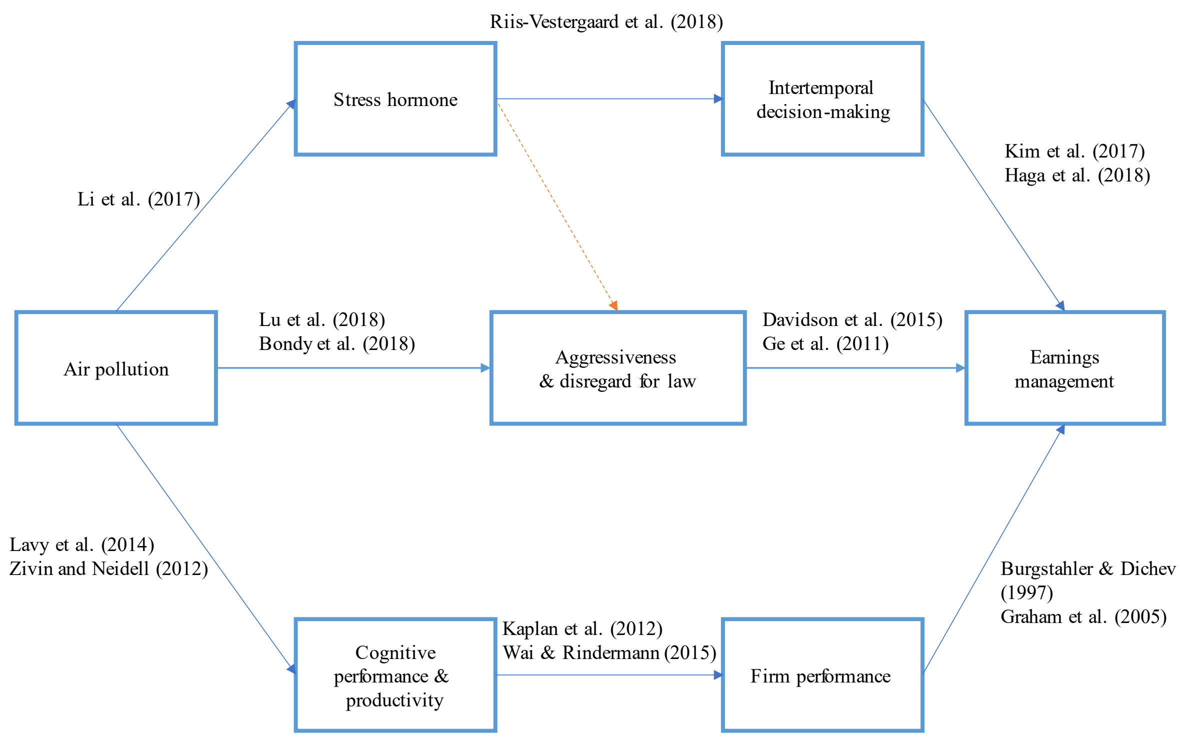
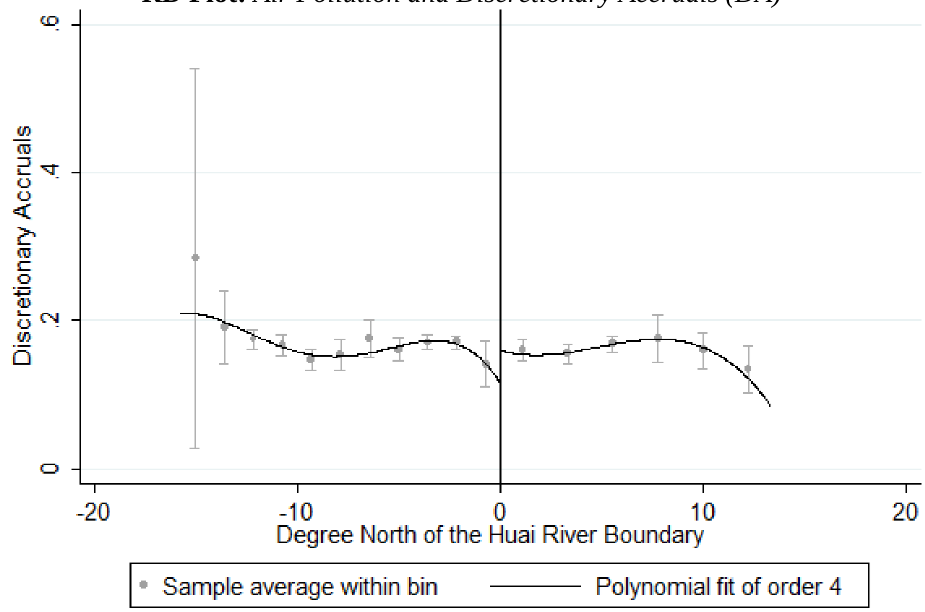


Figure 2: Earnings manipulation and Distance from the Heating Policy Line formed by *Qinling Mountain —Huai River*

RD Plot: *Air Pollution and Discretionary Accruals (DA)*



RD Plot: *Air Pollution and Financial Restatements (RESTATE)*

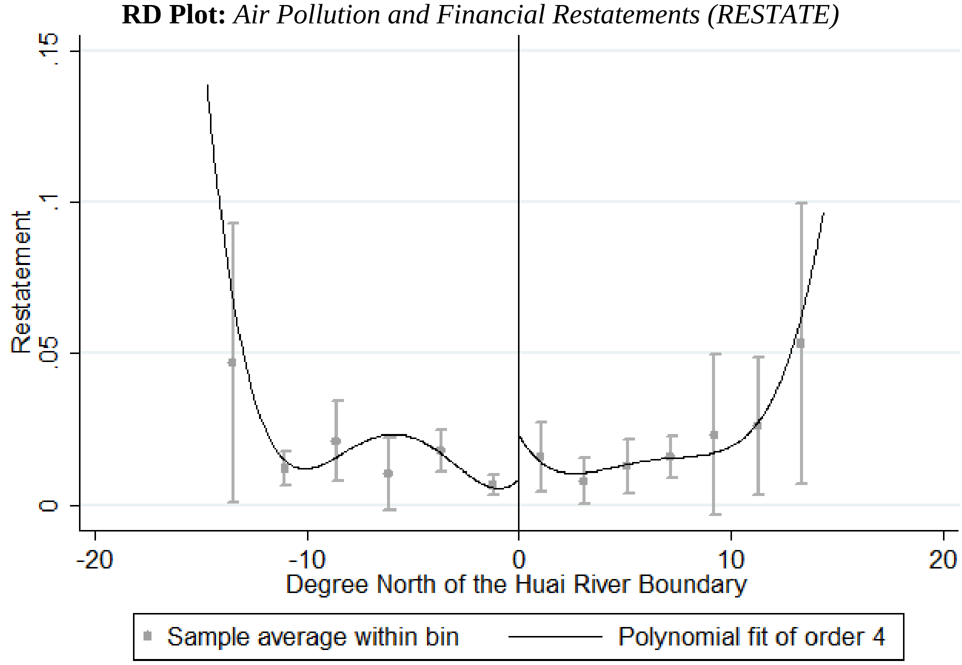


Table 1: Sample Selection

Panel A: Sample selection

Initial Sample:	
Chinese firms listed in A-share market during 2014 to 2017	**12,068**
Drop:	
Observations in financial industries	272
Observations missing data on *AP*	246
Observations missing data on dependent variable	1,025
Observations missing data on the other variables in our baseline model	1,017
Total	**9,508**

Panel B: Sample distribution

	Industry Name	N	%
A	Agricultures, Forestry & Fishing	126	1.33%
B	Mining	257	2.70%
C0	Food & Beverage	355	3.73%
C1	Textile, Clothing & Fur	238	2.50%
C2	Wood & Furniture	54	0.57%
C3	Papermaking & Printing	144	1.51%
C4	Petroleum, Chemistry & Plastic	876	9.21%
C5	Electronic	574	6.04%
C6	Metal & Nonmetal	687	7.23%
C7	Machine, Equipment & Meter	2,072	21.79%
C8	Medicine & Biologics	554	5.83%
C9	Other Manufacturing	55	0.58%
D	Utilities	333	3.50%
E	Construction	288	3.03%
F	Transportation & Warehousing	294	3.09%
G	Information Technology	960	10.10%
H	Wholesale & Retail Trade	537	5.65%
J	Real Estate	436	4.59%
K	Services	400	4.21%
L	Communications & Cultural Industry	182	1.91%
M	Conglomerates	86	0.90%

Table 2: Descriptive Statistics and Correlation matrix

Panel A: Descriptive Statistics

Variables	N	Mean	Std. Dev.	25%	Median	75%
DA	9,508	0.166	0.189	0.048	0.110	0.212
RESTATE	9,508	0.014	0.116	0.000	0.000	0.000
AP	9,508	0.803	0.221	0.650	0.790	0.948
SOE	9,508	0.361	0.480	0.000	0.000	1.000
SIZE	9,508	8.431	1.277	7.534	8.278	9.154
BM	9,508	0.776	0.808	0.293	0.505	0.912
ROA	9,508	0.036	0.053	0.013	0.034	0.062
OCF	9,508	0.041	0.070	0.002	0.040	0.082
LEV	9,508	0.569	0.210	0.414	0.582	0.737
OREC	9,508	0.016	0.024	0.003	0.008	0.018
SEG	9,508	2.516	0.993	1.946	2.565	3.135
LOSS	9,508	0.095	0.293	0.000	0.000	0.000
ST	9,508	0.017	0.129	0.000	0.000	0.000
AGE	9,508	2.345	0.659	1.946	2.398	2.944
CROSS	9,508	0.058	0.233	0.000	0.000	0.000
FSR	9,508	0.341	0.148	0.223	0.321	0.440
DUAL	9,508	0.268	0.443	0.000	0.000	1.000
BRD	9,508	8.550	1.689	7.000	9.000	9.000
IDR	9,508	0.375	0.053	0.333	0.357	0.429
BIG4	9,508	0.056	0.229	0.000	0.000	0.000
GDP	9,508	0.086	0.037	0.069	0.085	0.104
MKT	9,508	8.363	1.611	7.030	9.140	9.640

Panel B: Pearson correlation matrix

Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1) *AP*	1.000																			
(2) *SOE*	**0.153**	1.000																		
(3) *SIZE*	**0.082**	**0.358**	1.000																	
(4) *BM*	**0.101**	**0.362**	**0.710**	1.000																
(5) *ROA*	**-0.028**	**-0.141**	-0.012	**-0.221**	1.000															
(6) *OCF*	**-0.018**	0.013	**0.037**	**-0.084**	**0.382**	1.000														
(7) *LEV*	**-0.065**	**-0.291**	**-0.502**	**-0.594**	**0.382**	**0.192**	1.000													
(8) *SEG*	**-0.050**	**0.083**	**0.573**	**0.370**	-0.007	**-0.033**	**-0.333**	1.000												
(9) *AGE*	**0.046**	**0.463**	**0.357**	**0.326**	**-0.218**	**-0.040**	**-0.365**	**0.229**	1.000											
(10) *LOSS*	0.015	**0.063**	**-0.072**	**0.049**	**-0.645**	**-0.171**	**-0.194**	**-0.051**	**0.126**	1.000										
(11) *ST*	-0.006	**0.038**	**-0.065**	0.004	**-0.073**	**-0.042**	**-0.106**	**-0.047**	**0.096**	**0.047**	1.000									
(12) *OREC*	-0.008	-0.005	**0.066**	**0.132**	**-0.151**	**-0.155**	**-0.225**	**0.187**	**0.123**	**0.080**	**0.045**	1.000								
(13) *CROSS*	-0.015	**0.205**	**0.284**	**0.183**	**-0.030**	**0.026**	**-0.120**	**0.128**	**0.195**	0.004	0.006	0.003	1.000							
(14) *FSR*	**0.054**	**0.244**	**0.241**	**0.157**	**0.110**	**0.117**	**-0.075**	**0.019**	**-0.049**	**-0.069**	**-0.052**	**-0.073**	**0.058**	1.000						
(15) *DUAL*	**-0.096**	**-0.281**	**-0.159**	**-0.137**	**0.061**	-0.005	**0.114**	**-0.048**	**-0.213**	**-0.028**	-0.009	**-0.018**	**-0.059**	**-0.047**	1.000					
(16) *BRD*	**0.073**	**0.269**	**0.285**	**0.208**	-0.006	**0.054**	**-0.157**	**0.116**	**0.168**	-0.012	0.001	0.009	**0.112**	**0.037**	**-0.186**	1.000				
(17) *IDR*	**-0.050**	**-0.066**	-0.010	0.001	**-0.025**	**-0.019**	0.009	0.011	**-0.047**	**0.032**	0.004	**0.027**	**0.030**	**0.031**	**0.120**	**-0.512**	1.000			
(18) *BIG4*	**0.040**	**0.142**	**0.358**	**0.211**	**0.038**	**0.089**	**-0.117**	**0.140**	**0.091**	**-0.040**	**-0.021**	**0.019**	**0.410**	**0.161**	**-0.063**	**0.090**	**0.032**	1.000		
(19) *GDP*	**-0.253**	**-0.049**	-0.016	-0.006	**0.079**	-0.008	**0.045**	**0.058**	**-0.059**	**-0.056**	**-0.044**	**0.027**	-0.006	0.000	**0.037**	**-0.026**	0.013	-0.007	1.000	
(20) *MKT*	**-0.246**	**-0.174**	**-0.043**	**-0.115**	**0.140**	**0.025**	**0.118**	**0.075**	**-0.187**	**-0.108**	**-0.082**	**-0.026**	**0.075**	0.016	**0.113**	**-0.080**	0.015	**0.056**	**0.156**	1.000

Panel A presents descriptive statistics. Panel B presents the Pearson correlation matrix. Correlation coefficients in bold are significant at 10% or better.

Table 3: The Effect of Air Pollution on Earnings manipulation

Dep. Var.	= *DA*		= *RESTATE*	
	Coefficients	t-value	*Coefficients*	z-value
AP	**0.097****	**2.34**	**1.774****	**2.03**
SOE	-0.023***	-4.31	-0.044	-0.41
SIZE	0.003	0.80	-0.128*	-1.95
BM	-0.008*	-1.83	0.071	0.97
ROA	0.305***	4.96	-2.945**	-2.35
OCF	-0.102***	-3.02	-0.349	-0.62
LEV	-0.018	-1.13	0.060	0.27
SEG	-0.011***	-4.16	0.065	1.23
AGE	0.001	0.34	0.106	1.34
LOSS	0.007	0.78	-0.069	-0.43
ST	0.042**	2.08	0.870***	4.49
OREC	0.092	0.97	2.735**	2.28
CROSS	-0.007	-0.74	-0.327	-1.59
FSR	0.002	0.12	-0.340	-1.14
DUAL	0.004	0.78	0.168**	2.06
BRD	-0.004**	-2.50	0.010	0.36
IDR	-0.090**	-2.07	1.104	1.32
BIG4	-0.007	-0.71	0.261	1.45
GDP	-0.051	-0.60	1.490	0.86
MKT	-0.012***	-2.76	0.172*	1.88
Intercept	0.252***	3.90	-7.315	-0.94
City Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
Industry Fixed Effects	Yes		Yes	
observations	9,508		9,508	
Adj./Pseudo R^2	0.061		0.206	

This table presents the results of the effect of air pollution on earnings manipulation. The dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 4: PSM Sample Test

Panel A: Descriptive Statistics for the Sample before and after PSM

Variables	***Pooled Sample***			***PSM Sample***		
	Less Polluted Cities (N=4,893)	More Polluted Cities (N=4,615)	*Difference*	Less Polluted Cities (N=2,987)	More Polluted Cities (N=2,987)	*Difference*
SOE	0.295	0.431	-0.136***	0.380	0.368	0.012
SIZE	8.340	8.527	-0.187***	8.451	8.403	0.048
BM	0.710	0.845	-0.135***	0.780	0.762	0.018
ROA	0.039	0.034	0.005***	0.037	0.036	0.001
OCF	0.043	0.038	0.005***	0.040	0.040	0.000
LEV	0.580	0.557	0.023***	0.569	0.569	-0.001
SEG	2.541	2.491	0.050**	2.508	2.492	0.016
AGE	2.310	2.382	-0.072***	2.341	2.356	-0.015
LOSS	0.090	0.101	-0.011*	0.092	0.099	-0.007
ST	0.016	0.018	-0.002	0.017	0.017	0.000
OREC	0.016	0.016	0.000	0.017	0.016	0.000
CROSS	0.061	0.054	0.007	0.053	0.053	-0.001
FSR	0.338	0.344	-0.006**	0.339	0.340	-0.001
DUAL	0.297	0.236	0.061***	0.257	0.266	-0.009
BRD	8.461	8.644	-0.182***	8.590	8.551	0.039
IDR	0.377	0.373	0.003***	0.374	0.376	-0.002
BIG4	0.047	0.064	-0.017***	0.060	0.051	0.009
GDP	0.093	0.079	0.014***	0.085	0.083	0.001
MKT	8.815	7.883	0.932***	8.338	8.286	0.051

Panel B: PSM Sample Regression

Dep. Var.	= *DA*		= *RESTATE*	
	Coefficients	t-value	*Coefficients*	z-value
AP	**0.112****	**2.18**	**2.623****	**2.43**
SOE	-0.026***	-3.85	-0.001	-0.01
SIZE	0.004	0.80	-0.010	-0.13
BM	-0.006	-1.00	0.063	0.72
ROA	0.378***	4.49	-2.725	-1.60
OCF	-0.108**	-2.51	-0.870	-1.16
LEV	-0.034	-1.60	0.405	1.48
SEG	-0.012***	-3.50	0.032	0.51
AGE	-0.001	-0.13	0.026	0.27
LOSS	0.011	0.95	0.022	0.11
ST	0.029	1.10	0.897***	3.53
OREC	0.106	0.93	3.022**	2.08
CROSS	-0.023*	-1.87	-0.358	-1.41
FSR	-0.034*	-1.77	-0.644*	-1.77
DUAL	0.003	0.40	0.307***	2.98

BRD	-0.005**	-2.40	-0.009	-0.27
IDR	-0.127**	-2.22	1.098	1.01
BIG4	0.008	0.55	0.234	1.02
GDP	-0.049	-0.43	0.696	0.34
MKT	-0.009	-1.64	0.124	1.26
Intercept	0.253***	3.04	-2.478***	-3.34
City Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
Industry Fixed Effects	Yes		Yes	
observations	5,974		5,974	
Adj./Pseudo R^2	0.044		0.249	

This table presents the regression results of the effect of air pollution on earnings manipulation by matched sample. In Panel A, the higher (lower) pollution group is defined as firm-years in cities whose air pollution is above (equal or below) the median of city-years. In Panel B, the dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 5: RD Estimates of the Impact of the Qinling Mountain-Huai River Heating Policy

Panel A: Non-Parametric Test

Dep. Var.	= *DA*		= *RESTATE*	
	Coefficient	*z-value*	*Coefficient*	*z-value*
North	**0.115*** **	**5.78**	**0.179*** **	**9.504**
Control Variable	Yes		Yes	
City Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
Industry Fixed Effects	Yes		Yes	
Bandwidth	2.94°		2.75°	
Observations	9,508		9,508	

Panel B: Local Parameter OLS Regression Test

Dep. Var.	= *DA*		= *RESTATE*	
	Coefficient	*t-value*	*Coefficient*	*z-value*
Treat	**0.096** **	**(2.04)**	**0.888** **	**(2.17)**
SOE	-0.015	(-1.21)	-0.228	(-0.90)
SIZE	-0.013	(-1.47)	0.090	(0.65)
BM	0.029**	(2.16)	0.052	(0.38)
ROA	0.547***	(3.55)	-3.285	(-1.45)
OCF	-0.099	(-1.12)	1.466*	(1.79)
LEV	0.039	(1.05)	-1.173**	(-2.18)
SEG	-0.005	(-0.77)	-0.232**	(-2.48)
AGE	-0.015	(-1.54)	-0.258	(-1.54)
LOSS	0.030	(1.16)	0.126	(0.42)
ST	-0.014	(-0.41)	0.189	(0.41)
OREC	-0.076	(-0.28)	6.121**	(2.52)
CROSS	-0.019	(-0.70)	-0.134	(-0.27)
FSR	0.001	(0.03)	0.119	(0.23)
DUAL	0.002	(0.13)	0.095	(0.45)
BRD	-0.005	(-1.27)	0.139**	(2.19)
IDR	0.021	(0.16)	1.077	(0.61)
BIG4	0.053	(1.16)	-0.164	(-0.38)
GDP	-0.110	(-0.43)	3.114	(1.14)
MKT	-0.008*	(-1.83)	0.078	(1.30)
Intercept	0.383***	(2.94)	-3.421***	(-2.83)
City Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
Industry Fixed Effects	Yes		Yes	
Observations	1,459		1,955	
Adj./Pseudo R^2	0.066		0.149	

This table presents the results of discontinuity regression design (RDD). The dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 6: Controlling for Weather Conditions

Dep. Var.	= *DA*		= *RESTATE*	
AP	**0.092****	**0.097****	**1.424*****	**1.738****
	(2.21)	(2.33)	(2.77)	(2.03)
HOTDAY	0.193		-4.639	
	(0.82)		(-1.16)	
WINDAY	0.017		0.005	
	(1.38)		(0.01)	
SUNDAY	-0.006		-0.181	
	(-0.72)		(-0.93)	
WEA_SCORE		-0.001		0.069
		(-0.27)		(1.02)
SOE	-0.023***	-0.023***	-0.023	-0.044
	(-4.31)	(-4.30)	(-0.21)	(-0.41)
SIZE	0.003	0.003	-0.132**	-0.128*
	(0.79)	(0.80)	(-2.07)	(-1.95)
BM	-0.007*	-0.008*	0.059	0.070
	(-1.81)	(-1.82)	(0.84)	(0.96)
ROA	0.305***	0.305***	-2.977**	-2.985**
	(4.95)	(4.97)	(-2.44)	(-2.38)
OCF	-0.102***	-0.102***	-0.262	-0.352
	(-3.02)	(-3.03)	(-0.46)	(-0.62)
LEV	-0.018	-0.018	0.048	0.065
	(-1.12)	(-1.12)	(0.22)	(0.29)
SEG	-0.011***	-0.011***	0.089*	0.066
	(-4.16)	(-4.16)	(1.71)	(1.25)
AGE	0.001	0.001	0.107	0.106
	(0.34)	(0.34)	(1.36)	(1.34)
LOSS	0.007	0.007	-0.083	-0.073
	(0.78)	(0.79)	(-0.53)	(-0.46)
ST	0.042**	0.042**	0.781***	0.877***
	(2.09)	(2.09)	(4.14)	(4.52)
OREC	0.092	0.092	2.957**	2.725**
	(0.97)	(0.97)	(2.51)	(2.29)
FSR	0.002	0.002	-0.298	-0.345
	(0.11)	(0.12)	(-1.02)	(-1.16)
DUAL	0.004	0.004	0.160*	0.169**
	(0.77)	(0.78)	(1.96)	(2.07)
BRD	-0.004**	-0.004**	0.009	0.011
	(-2.51)	(-2.50)	(0.33)	(0.39)
IDR	-0.090**	-0.090**	1.081	1.116
	(-2.08)	(-2.07)	(1.33)	(1.33)
BIG4	-0.007	-0.007	0.257	0.262
	(-0.71)	(-0.71)	(1.43)	(1.46)
GDP	-0.056	-0.051	1.403	1.601
	(-0.67)	(-0.60)	(0.89)	(0.91)

MKT	-0.012***	-0.012***	0.136*	0.174*
	(-2.77)	(-2.76)	(1.72)	(1.89)
Intercept	0.253***	0.254***	-7.413	-7.465
	(3.86)	(3.92)	(-1.51)	(-1.35)
City Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	9,508	9,508	9,508	9,508
Adj./Pseudo R^2	0.061	0.061	0.189	0.207

This table presents the results of controlling for weather condition. The dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values in parentheses are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 7: Alternative Samples

Dep. Var.	*Excluding Non-Concentrated Firms*		*Parent Companies*	*Excluding Polluting Industries*	
	= DA	*= RESTATE*	*=DA^{parent}*	*= DA*	*= RESTATE*
AP	**0.115*****	**1.195****	**0.025***	**0.098***	**1.274****
	(2.60)	(2.18)	(1.66)	(1.72)	(2.17)
SOE	-0.020***	-0.026	-0.011***	-0.029***	-0.024
	(-3.52)	(-0.21)	(-4.29)	(-4.18)	(-0.19)
SIZE	0.003	-0.156**	-0.003*	0.009**	-0.085
	(0.69)	(-2.14)	(-1.92)	(2.08)	(-1.09)
BM	-0.011**	0.129	-0.007***	-0.011*	-0.057
	(-2.21)	(1.50)	(-4.10)	(-1.83)	(-0.60)
ROA	0.256***	-2.997**	0.214***	0.405***	-3.164**
	(3.95)	(-2.17)	(8.49)	(4.70)	(-2.12)
OCF	-0.078**	-0.687	-0.090***	-0.080*	-0.539
	(-2.19)	(-1.15)	(-4.10)	(-1.87)	(-0.80)
LEV	0.003	0.149	-0.045***	-0.010	0.050
	(0.15)	(0.62)	(-8.09)	(-0.47)	(0.18)
SEG	-0.011***	0.076	-0.001	-0.009**	0.050
	(-3.73)	(1.34)	(-0.83)	(-2.34)	(0.73)
AGE	0.001	0.113	0.006***	0.006	0.117
	(0.28)	(1.33)	(2.89)	(1.11)	(1.35)
LOSS	0.004	-0.096	0.017***	0.022*	-0.153
	(0.42)	(-0.58)	(5.72)	(1.66)	(-0.79)
ST	0.040*	0.911***	0.001	0.045	0.817***
	(1.84)	(4.08)	(0.18)	(1.53)	(2.96)
OREC	0.114	2.991**	0.068***	-0.012	4.310***
	(1.12)	(2.22)	(6.86)	(-0.11)	(3.04)
CROSS	-0.008	-0.220	0.002	-0.015	-0.251
	(-0.79)	(-1.01)	(0.36)	(-1.26)	(-1.06)
FSR	0.000	-0.155	0.011*	0.001	-0.142
	(0.01)	(-0.48)	(1.73)	(0.07)	(-0.41)
DUAL	0.005	0.191**	0.004**	0.008	0.189**
	(0.93)	(2.14)	(2.01)	(1.27)	(1.98)
BRD	-0.004**	-0.006	-0.000	-0.003	0.001
	(-2.21)	(-0.19)	(-0.30)	(-1.35)	(0.03)
IDR	-0.071	0.686	0.031	-0.069	1.541
	(-1.48)	(0.76)	(1.63)	(-1.25)	(1.49)
BIG4	-0.005	0.215	-0.007	-0.010	-0.146
	(-0.50)	(1.03)	(-1.64)	(-0.73)	(-0.60)
GDP	-0.044	0.223	0.013	-0.124	1.699
	(-0.47)	(0.14)	(0.37)	(-0.94)	(0.87)
MKT	-0.012**	0.215*	-0.003*	-0.013**	0.078
	(-2.14)	(1.93)	(-1.65)	(-2.30)	(0.78)
Intercept	0.216***	-2.026***	0.035	0.415***	-2.198***
	(2.96)	（-2.83）	(1.35)	(3.38)	(-2.75)

City Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	8,396	8,396	8,630	6,064	6,064
Adj./Pseudo R^2	0.057	0.225	0.120	0.069	0.213

This table presents the results of using alternative sample. The dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values in parentheses are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 8: Controlling for Geographical Distance between Firms and Regulators

Dep. Var.	*= RESTATE*	
	Coefficients	z-value
AP	**1.772****	**(2.03)**
DIST_CSRC	**0.422*****	**(8.67)**
Controls	Yes	
City Fixed Effects	Yes	
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
observations	9,508	
Pseudo R^2	0.150	

This table presents the results of using an alternative model specification. DIST_CSRC is the distance between the firm's headquarters and CSRC (China Securities Regulatory Commission, the counterpart of the SEC in China). The z-values are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Table 9: Alternative Measures of Air Pollution

Dep. Var.	= *DA*			= *RESTATE*		
AP_ANO	**0.001****			**0.069*****		
	(2.10)			(5.23)		
AP_REG		**0.001****			**0.015*****	
		(1.99)			(3.31)	
AP_RATE			**0.052****			**0.983****
			(2.25)			(2.00)
SOE	-0.022***	-0.023***	-0.023***	-0.053	-0.048	-0.046
	(-5.01)	(-4.34)	(-4.31)	(-0.52)	(-0.48)	(-0.43)
SIZE	0.002	0.003	0.003	-0.148**	-0.141**	-0.129*
	(0.76)	(0.79)	(0.80)	(-2.51)	(-2.35)	(-1.95)
BM	-0.008*	-0.008**	-0.008*	0.096	0.089	0.071
	(-1.88)	(-1.99)	(-1.84)	(1.48)	(1.36)	(0.97)
ROA	0.311***	0.304***	0.306***	-2.757**	-3.341***	-2.944**
	(5.21)	(5.00)	(4.97)	(-2.50)	(-2.97)	(-2.34)
OCF	-0.100***	-0.097***	-0.102***	-0.044	-0.205	-0.337
	(-2.74)	(-2.90)	(-3.02)	(-0.09)	(-0.40)	(-0.60)
LEV	-0.019	-0.020	-0.018	-0.333	-0.377*	0.066
	(-1.33)	(-1.22)	(-1.12)	(-1.55)	(-1.73)	(0.30)
SEG	-0.011***	-0.011***	-0.011***	0.018	0.024	0.065
	(-4.82)	(-3.97)	(-4.16)	(0.38)	(0.50)	(1.24)
AGE	0.001	0.002	0.001	0.119	0.099	0.106
	(0.44)	(0.55)	(0.33)	(1.62)	(1.35)	(1.34)
LOSS	0.006	0.007	0.007	-0.071	-0.110	-0.066
	(0.72)	(0.79)	(0.78)	(-0.48)	(-0.75)	(-0.42)
ST	0.042*	0.040**	0.042**	0.745***	0.688***	0.878***
	(1.82)	(2.00)	(2.09)	(4.28)	(3.84)	(4.53)
OREC	0.088	0.107	0.091	2.801**	2.791**	2.723**
	(1.13)	(1.12)	(0.96)	(2.35)	(2.42)	(2.28)
CROSS	-0.006	-0.007	-0.006	-0.232	-0.258	-0.326
	(-0.67)	(-0.81)	(-0.73)	(-1.20)	(-1.34)	(-1.58)
FSR	0.002	-0.001	0.002	-0.335	-0.326	-0.341
	(0.13)	(-0.10)	(0.12)	(-1.20)	(-1.17)	(-1.15)
DUAL	0.004	0.005	0.004	0.158**	0.158**	0.170**
	(1.00)	(0.96)	(0.78)	(2.02)	(2.02)	(2.08)
BRD	-0.004**	-0.004**	-0.004**	0.002	0.008	0.011
	(-2.26)	(-2.30)	(-2.50)	(0.09)	(0.32)	(0.37)
IDR	-0.091***	-0.075*	-0.090**	1.063	1.139	1.097
	(-2.62)	(-1.72)	(-2.07)	(1.37)	(1.51)	(1.30)
BIG4	-0.006	-0.004	-0.007	0.246	0.190	0.262
	(-0.69)	(-0.45)	(-0.70)	(1.49)	(1.15)	(1.45)
GDP	-0.022	-0.035	-0.043	0.503	-0.200	1.590
	(-0.31)	(-0.39)	(-0.51)	(0.39)	(-0.14)	(0.92)
MKT	-0.012***	-0.003	-0.012***	0.161**	0.310**	0.172*
	(-2.89)	(-0.26)	(-2.78)	(2.07)	(2.21)	(1.88)

Intercept	0.313***	0.187**	0.276***	-1.673***	0.276***	-2.127***
	(6.65)	(2.01)	(4.66)	(-2.72)	(4.66)	(-3.26)
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,508	9,472	9,508	9,508	9,472	9,508
Adj./PseudoR^2	0.060	0.061	0.061	0.215	0.203	0.206

This table presents the results of using alternative measures of air pollution. The dependent variables are *DA* and *RESTATE*, respectively. See the Appendix for the definitions of the other variables. The t-values/z-values in parentheses are based on heteroskedasticity-consistent standard errors that are clustered by firm. ***, **, and * indicate two-tailed significance at the 1%, 5%, and 10% levels respectively.

Appendix: Definitions of Variables

Variables	*Definitions*
DA=	Discretionary accruals, equal to the absolute value of the residual estimated from the modified Jones model by each industry-year with at least 15 observations.
RESTATE=	Restatement, an indicator variable taking a value of 1 if the t year's financial restatement is restated, excluding the tax and upwards adjustment, and 0 otherwise.
AP=	Air pollution, which is calculated as the mean value of the daily Air Quality Index (AQI) in the cities in which the firm is headquartered from Jan. 1st to the Dec. 31st, divided by 100. The higher the value, the more severe the air pollution.
SOE=	Ownership, an indicator variable taking a value of 1 if the firm is state-owned, and 0 otherwise.
SIZE=	Firm size, which is calculated as the natural logarithm of total assets.
BM=	Ratio of book value to market value, which is calculated as the book value of total assets divided by the market value of total assets.
ROA=	Profitability, which is equal to net income divided by total assets.
OCF=	Operating cash flow, which is calculated as the operating cash flow scaled by total assets.
LEV=	Leverage, which is calculated as total liabilities divided by total assets.
SEG=	Operation complexity, calculated as the natural logarithm of one plus the number of subsidiaries.
AGE=	List years, equal to the number of years a company has been listed.
LOSS=	Indicator variable taking a value of 1 if the firm reports a loss, and 0 otherwise.
ST=	Listing status, an indicator variable taking a value of 1 if the firm is specially treated (*ST*), and 0 otherwise.
OREC=	The intensity of other accounts receivable, calculated as the other accounts receivable scaled by total assets.
CROSS=	Cross listing, an indicator variable taking a value of 1 if the firm is listed in a capital market outside mainland China as an A-share, and 0 otherwise.
FSR=	The percentage of shares hold by the largest shareholder, calculated as the number of shares the largest shareholder holds divided by the number of total shares.
DUAL=	Duality, an indicator variable taking a value of 1 if the firm's CEO is also the chair of the board of directors, and 0 otherwise.
DIST_CSRC =	Distance between the firm's headquarters and CSRC (China Securities Regulatory Commission)
BRD=	Board of directors' size, which is calculated as the natural logarithm of the total number of directors on the board.
IDR=	Independent director ratio, which is calculated as the number of independent directors divided by the total number of directors on the board.

BIG4=	Big 4 audit firm, an indicator variable taking a value of 1 if the firm is audited by a Big 4 audit firm, and 0 otherwise.
GDP=	The macroeconomic condition, measured as the GDP growth rate of the city where the firm is located in.
MKT=	The degree of marketization, measured as the Marketization Index of the province in which the firm is located in year t.
DA^{parent}	Discretionary accruals, calculated based on the parent statements data, equal to the absolute value of the residual estimated from the modified Jones model by each industry-year with at least 15 observations.
AP_ANO=	Air pollution, which is calculated as the mean value of the daily Air Quality Index (AQI) in the cities in which the firm is headquartered from Jan. 1^{st} to the date of issuing financial reports, divided by 100. The higher the value, the more severe the air pollution.
AP_REG=	Air pollution, which is calculated as the mean value of the daily Air Quality Index (AQI) in the cities in which the firm's registered address is from Jan. 1^{st} to the Dec. 31st, divided by 100. The higher the value, the more severe the air pollution.
AP_RATE=	Air pollution level, calculated as the mean value of daily air pollution rating (from 0 to 5 indicating excellent air quality to heavy pollution).