Polluted IPOs*

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Abstract

This study examines how the negative impact of air pollution on regulatory decision-making can lead to unexpectedly favorable capital-raising outcomes for firms. Chinese companies must undergo a review by a regulator-appointed committee before proceeding with initial public offerings (IPOs). We find that firms are more likely to pass this review on polluted days (i.e., days with higher PM2.5 levels), likely due to reduced cognitive capacity among reviewers, as reflected in fewer and simpler questions asked during the review. Politically unconnected firms, which are typically less likely to gain approval, see an increased chance of passing on these polluted days. Firms approved on polluted days show no significant performance difference from other firms within three years after the IPO. This evidence suggests that the adverse effects of air pollution on high-stakes decision-makers may help offset distortions tied to a politically influenced IPO system.

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1 Introduction

There is a growing consensus in the literature that transitory air pollution has a substantial negative impact on the cognitive and physical abilities of workers, investors, and other important economic agents (e.g., Chang et al., 2019, He et al., 2019, Huang et al., 2020, Dong et al., 2021, Adhvaryu et al., 2022). However, the broader implications of this effect on the well-functioning of the financial system remain largely underexplored. While reduced cognitive abilities of economic agents are expected to lead to lower efficiency in decision-making, air pollution may unexpectedly *improve* economic outcomes in a system that is subject to the discretion and biases of government agents.

In many countries, particularly those in the developing world, policymakers often impose overly strict rules and regulations on financial markets. Government agents are at the center of effectively enforcing these regulations, making the enforcement process susceptible to their subjectivity and biases. Although air pollution can negatively affect the cognitive abilities of these agents, it may paradoxically benefit firms and financial markets by weakening agents' influence and intervention. This study uses the Chinese initial public offerings (IPO) system as a unique setting to explore how the detrimental impact of air pollution on regulatory decision-making can lead to unexpectedly positive capital-raising outcomes for firms.

Chinese companies going public face strict scrutiny from the China Securities Regulatory Commission (CSRC), the regulatory agency governing firms' capital raising in China. A key component of the process is a review session, known as the Listing Committee Meetings, during which a seven-member committee appointed by the CSRC poses questions to the firm and its underwriters and uses their responses to determine the firm's suitability for listing. Although the process is intended to provide effective regulatory oversight by leveraging the expertise of review members to screen out companies with poor performance and prospects, it is subject to potential biases, errors, and favoritism (Qian et al., 2022). For example, committee members may intentionally pose challenging questions to certain firms, particularly those without political connections, in order to deny their IPO applications.(Chen et al., 2017).

All review meetings take place at the CSRC headquarters in Beijing, a city plagued by severe fine particulate air pollution (PM2.5) for years due to coal-powered industrial production and heating (Douglas et al., 2009). As small pollutants such as PM2.5 travel indoors, air pollution can directly affect committee members during those meetings. However, the effect of air pollution on the type of firms approved for listing and the overall economic outcome for corporate capital raising remains unclear due to biases inherent in the existing system. On the one hand, air pollution may reduce the effectiveness of regulatory oversight by impairing reviewers' cognitive abilities, making it harder for them to filter out unqualified firms. On the other hand, the same limitation might lead to an unexpected positive economic outcome: more qualified companies may be able to raise capital because reviewers are less capable of posing challenging questions that could otherwise scrutinize and reject less favorable firms. In this study, we first investigate whether the IPO review outcome varies based on the density of fine particulate air pollutants on the review day and the types of firms approved for listing on polluted days. We then zoom in on analyzing the transcripts of the review sessions and explore the implications for the IPO system.

The study sample consists of 1,488 IPO applications filed in China between 2014 and 2020, retrieved from the China Stock Market and Accounting Research (CSMAR) database. For each review meeting, we obtain the names of the committee members, the names of the IPO firms, and the review decisions from the CSRC website. For each individual review member, we manually collect their full resume to determine the member's personal characteristics and professional backgrounds. Half of the review members assigned to the Q&A sessions are full-time employees of the CSRC, while the rest are affiliated with financial institutions, law firms, and academic institutions.

Our identification strategy takes advantage of two unique institutional features. First, the review committee composition is randomly determined by the CSRC. It uses a lottery system to ensure the homogeneous quality of the review team for each IPO, ensuring no endogenous matching between committee members and firm quality. Importantly, it is mandatory for reviewers to be physically present on the day of the review. Second, because the timing of the IPO review is predetermined one week before the review date and the correlation between PM2.5 levels on the

review day and a week prior is close to zero, members of the committee cannot predict the air quality on the review day and thus prepare questions differently ahead of time. Both conditions ensure that pollution levels on the review day do not capture unobservable firm quality and committee heterogeneity.

Our analysis starts with a robust and ubiquitous finding: IPO approval rates are significantly higher on polluted days (i.e., days with higher PM2.5 levels) than on clear days. We find that every increase of 100 $\mu g/m^3$ in PM2.5 concentration during working hours on the review day leads to about 4.5 percentage points higher approval probability, representing a more than 5% increase over the unconditional mean of 85%. Our baseline specifications include controls for the listing firm's characteristics; review members' personal attributes and professional backgrounds; weather conditions; and industry, province, quarter, and committee chairman fixed effects. Our results are robust to a comprehensive set of additional tests such as including the day of the week fixed effects, calendar month fixed effects, firm city fixed effects, and committee employment period fixed effects and subsample tests excluding the introduction of the STAR Market of Shanghai Stock Exchange, periods of economic stimulus, periods of intense pollution control, and the COVID-19 period. Moreover, we perform falsification tests using PM2.5 levels observed at the same monitoring station but during non-working hours or PM2.5 readings in an adjacent city. We also conduct two-stage least squares regressions using local wind speed as an instrumental variable to show the robustness of our baseline results.

A natural explanation for the higher IPO approval rate on days with high densities of fine particulate matter (PM2.5) is the reduced cognitive capacity of reviewers (Brunekreef and Holgate, 2002, Ebenstein, Lavy, and Roth, 2016). Reviewers' reduced ability to craft challenging questions and analyze answers likely leads to a higher passing rate. Our baseline evidence is less consistent with air pollution depressing reviewers' mood (Fonken et al., 2011, Dong et al., 2021), which should prompt reviewers to reject than approve more applications. We next present three pieces of evidence to support the cognitive ability channel through which air pollution affects the success rate of the reviews.

First, we explore the firm industry heterogeneity to demonstrate that the salience biases of reviewers intensify on polluted days as a result of diminished cognitive capacity. Prior studies such as Bordalo, Gennaioli, and Shleifer (2013) and Cosemans and Frehen (2021) show that the reduced cognitive capacity of decision-makers exacerbates salient biases. We expect reviewers to utilize more evident firm characteristics that are related to air pollution for making approval decisions. Specifically, reviewers may loosen (tighten) passing standards for green (polluted) businesses on polluted days. Indeed, we find that firms in green (polluted) sectors have higher (lower) passing rates on polluted days than on clear days. Because the review date (and thus firm quality) is assigned randomly, the evidence suggests that air pollution exacerbates salience biases in the committee's decision-making when they face limitations in their cognitive ability.

Second, we exploit firm heterogeneity in terms of complexity. A priori, firms with more complex operations are harder to evaluate and require more in-depth analysis by the committee members than are less complex firms. As a result, the cognitive capacity of committee members is particularly important for evaluating complex firms. We follow prior studies to measure complex firms using their R&D spending, industry segments, and geographic distribution. Our results show that despite having a lower probability of passing the review on average, complex firms' IPO applications are more likely to be approved on polluted days.

Last, we examine the review transcripts to provide direct evidence of the reduced cognitive capacity of reviewers. We obtained questions raised by committee members in all available review sessions between February 2015 and December 2020 from the CSRC website. We use the latent Dirichlet allocation (LDA) model in natural language processing to extract the essence of each question. We categorize all questions into two groups: complex questions, which require the reviewers to think deeply about the quality and development prospects of the company, and (simple) intuitive questions, which do not require in-depth thinking or analysis. We find that on days with high levels of pollution, committee members ask fewer, shorter, and less complex questions. More importantly, the committee members raise fewer follow-up questions within each topic af-

ter the main questions are answered. The evidence reflects the deterioration of reviewers' cognitive capacity, as follow-up questions rely more on improvisation than on preparation.

An implication of a higher average IPO approval rate on polluted days due to the reduced cognitive capacity of reviewers is that lax regulatory oversight leads to less qualified firms floating their shares, which is detrimental to investors' wealth. However, a contrasting interpretation is that the review committee is excessively critical and may reject too many qualified applications on non-polluted days. A higher approval rate associated with air pollution helps marginal firms to raise capital to fund their investments. In the final part of our paper, we provide evidence to shed light on whether a higher approval rate on polluted days reflects an outcome of reduced regulatory inefficiency or a manifestation of a reduced over-rejection rate.

We first examine the average quality of firms that pass the review on polluted days versus those on non-polluted days. We find that IPOs approved on polluted days and those approved on non-polluted days exhibit remarkably similar stock and accounting performance. In addition, the types of firms that are more likely to be approved on polluted days (such as those in green industries and complex firms) do not exhibit different post-IPO performance than other firms do. Moreover, we compare characteristics of IPOs that were rejected after the first review but approved at the second review and find that both firm characteristics and the composition of review committee members between the two reviews are remarkably similar. The evidence further demonstrates that ultimate success of an IPO largely relies on the review committee's decision, which can be biased and disentangled from firm fundamentals.

Next, we explore the interactions of firm political connections and review outcomes on polluted days. Prior studies suggest that the Chinese IPO system is characterized by a lack of transparency and reliance on human decisions, favoring politically connected firms over those without such ties (Fan et al., 2007, Chen et al., 2017, Cong and Howell, 2021, Qian et al., 2022). Politically connected companies can leverage their connections to influence the decisions of the review committee members. In contrast, firms without political connections may become targets for scrutiny: despite having the same qualifications, they are more likely to face tough questions

that hinder their success in listing. However, such scrutiny may be less effective during periods of high pollution, as the review committee members face lower cognitive capacity, making it harder for them to devise challenging questions to reject firms without political connections, benefiting those firms without political ties. Our results show that despite a 21% lower passing rate on average, firms without political connections are more likely to pass the review on polluted days. The evidence suggests that some non-connected firms are able to bypass the stringent review and successfully list their stocks as a result of air pollution.

Despite recent regulatory reforms and the introduction of the registration-based system for IPOs by the Chinese government, these reforms primarily transferred regulatory authority from the China Securities Regulatory Commission (CSRC) to stock exchanges without altering the core component of the approval system.[1] Companies seeking IPOs continue to face heightened regulatory scrutiny and intervention by government agents. The prolonged approval process is susceptible to the subjectivity and potential biases of those agents. Our findings imply that reducing the subjective component and unnecessary complexity of the process may improve overall regulatory efficiency.

Our paper contributes to the literature on regulatory oversight and offers important policy implications for capital markets in China and other developing economies. Previous studies suggest that stringent regulations can impose substantial costs on firms (Djankov et al., 2002). Additionally, political influence and regulatory capture can make government regulations counterproductive, as regulators fail to effectively screen companies, leading to regulatory failures (Shleifer and Vishny, 1993, 1998, Fisman, 2001, Reinikka and Svensson, 2004, Faccio et al., 2006). The fact that temporary disruptions caused by air pollution facilitate corporate capital raising underscores the reality that the regulatory system is vulnerable to human errors and biases.

Our paper also relates to the literature on the effects of transitory air pollution on high-stakes decision-makers in the economic system. Several recent papers document that air pollution has

[1]For information on how Chinese IPOs after registration reform still require government approvals, see https://www.reuters.com/markets/asia/chinas-latest-ipo-reform-unlikely-flood-markets-with-new-issuance-bankers-say-2023-02-03/

significant effects on an individual's decision-making and behavior. For example, air pollution affects the productivity of workers in both private and public sectors (Chang et al., 2016, Kahn and Li, 2020) and the behavioral biases of stock analysts, fund managers, and investors (Heyes et al., 2016, Huang et al., 2020, Wu et al., 2020, Dong et al., 2021, Li et al., 2021). In contrast to earlier studies, our research sheds light on the effects of air pollution on the performance of financial regulators, whose decisions are crucial to the efficient functioning of the financial markets. Using natural language processing techniques to analyze review session transcripts, we pinpoint the cognitive mechanisms by which air pollution disrupts the effectiveness of high-stakes decision-makers.

2 Background: IPO Approval in China

Firms in China are required to file for regulatory approval to the Securities Regulatory Commission of China (CSRC) to float their stocks on public exchanges. The listing firm has to meet some general criteria that were promulgated by the CSRC in 2006.[2] The requirement applies to firms for their listing on either the main board or the high-tech board (i.e., the growth enterprise board). The review process takes two and a half years on average, up to a maximum of five years (Luo and Wang, 2013, Song and Xin, 2017). During this period, firms are required to modify application materials periodically and to provide supplementary information under the supervision of CSRC officials. Firms that do not meet the basic listing requirements such as having insufficient revenues or breaches of the law are advised to withdraw their application. Although the process can be complex and lengthy, much of the success of a firm's IPO approval is determined, in fact, by the voting outcome of a review session organized by a formal committee appointed by the CSRC.

[2]The criteria include requirements for law compliance, corporate governance, and financial performance (Li and Zhou, 2015). For example, there should be no violation of law or any major changes to the main business, senior management, or controlling shareholder in the three fiscal years prior to listing; the firm must have good asset quality, reasonable asset-liability structure, strong profitability, sustainable cash flow, etc.

A review committee typically consists of seven members, randomly selected from an expert pool of more than 60 members.[3] Half of the members in that pool are full-time employees of the CSRC, and the rest are professionals working at financial intermediaries, accounting firms, and law firms, as well as academics affiliated with a reputable university (see Internet Appendix Table 2 for details on the composition). Each committee member serves a two-year term, with the possibility of reappointment. The committee members for each IPO are appointed one week before the review session, when they receive the IPO application materials.

During the review session, the committee typically raises three to four major questions, with each question consisting of sub-questions and follow-up questions, to the IPO firm and its underwriters. The review session typically lasts for 45 minutes, but longer sessions are held at times. After the session, the committee reaches a final decision that is released on the same day. There are three possible outcomes: pass, suspension of voting, and non-approval. Other than a straight pass, the remaining two outcomes are failed attempts.[4] Firms need consent from at least five out of seven members to receive formal approval. In practice, the voting decisions are often annonymous. It is important to note that the decision made by the review committee is final and cannot be appealed. There are no institutions that provide substantial oversight on the decisions made by committees.

The firm whose IPO application is rejected after the first review can reapply. The subsequent review process is similar to the initial one, with committee members randomly reselected by the system and no recusal rules for those involved in the previous review. The second application is often submitted and reviewed within a short period after the initial rejection. The quick turnaround is primarily a consideration of potential costs and uncertainty associated with a delay such as a complete update and re-audit of all financial data of the firm. In practice, not all companies reap-

[3] In a 2017 reform of the rules of the IPO review committee of the CSRC, the composition of each review committee was changed from fixed to random, with the members of each review committee chosen by lottery.

[4] "Suspension of voting" means a decision is not made immediately and the committee needs to review the application material further. Firms with "non-approval" can resubmit their application materials with substantial revision within six months. The committee typically provides one or two brief reasons for a rejection decision. For example, the reason given can be vague, such as "the independence of the firm is in question," "the operational situation of the firm will change dramatically," or "the informational disclosure of the firm is not standardized."

ply and only those that believe they have a strong chance tend to reapply, many of which succeed after the second round of review. While firms may learn from the initial rejection decision and make improvements in the next review session, the different outcomes within such a short period underscore the inherent randomness and potential for manipulation in the IPO approval system in China (Qian et al., 2022).[5]

3 Data Sample

3.1 IPO reviews

The China Stock Market and Accounting Research (CSMAR) database, one of China's most prominent financial and economic data providers, is our primary data source for IPO filings and approvals. Our sample consists of 1,488 IPO applications that completed their review sessions between 2014 and 2020 and have non-missing financial data.[6] An IPO review is regarded as a "pass" if the committee's decision is a straight pass. Two other outcomes, including suspension of voting and non-approval, are failed attempts. The approval rate varies from year to year. Overall, about 85% of applications receive a straight pass.[7]

Detailed information of the review sessions, including the names of the committee members and the review decisions, are obtained directly from the CSRC. We hand-collect the resumes of the committee members either from their previous employers or from Baidu baike (Chinese Wikipedia). The information collected for review members includes their gender, age, education, year of office, professional background, tenure at the CSRC, and whether they work at the CSRC

[5]The latest IPO reforms did not substantially change the approval process. China's registration system for IPO has been piloted in the Science and Technology Innovation Board (STAR) market since 2018, and it has been fully implemented in all listing boards since February 2023. However, the system imposes stricter standards, as claimed by the CSRC (see https://www.globaltimes.cn/page/202303/1287552.shtml). It only changed the governing body of the review from CSRC to the stock exchange, with tougher-than-normal queries discouraging market participants from the IPO process.

[6]We remove 38 IPOs whose reviews were canceled after scheduling because the firms were required to revise or supplement their application. Moreover, because initial IPO applications can be rejected after the review, our sample contains reviews for both first-time applications and subsequent applications if the first application is unsuccessful.

[7]Internet Appendix Table 3 summarizes the review outcomes included in our sample by year.

in a full-time capacity. We also obtain the transcripts of the review sessions, which include questions raised by the committee members that were made public for IPOs after 2015 (but not the responses by firms, which are not available to the public) from CSMAR. However, the identities of the reviewers for specific questions raised during the review are not published. That is, we know what questions are raised but do not know who raised them.

3.2 Air pollution

We obtain air quality monitoring data from the official website of the Ministry of Environmental Protection of China. The agency provides hourly readings of pollutant concentration ($\mu g/m^3$) in the air at various monitoring stations in Beijing. We use air quality data from the monitoring station located in North Xizhimen, the station nearest to the CSRC (approximately 1.5 kilometers), as a measure of the degree of pollution that may affect committee members. We calculate the average hourly PM2.5 levels between 8:00 a.m. and 6:00 pm, a period that covers both working hours and commuting hours. Figure 1 presents the monthly distribution (i.e., mean, 1%, and 99%) of daily PM2.5 readings at Xinzhimen station from April 2014 to December 2022. Two interesting patterns emerge from the figure. First, despite higher mean and extreme values during heating seasons, the non-heating seasons also saw spikes in PM2.5, perhaps as a result of industrial production powered by coal plants. Second, while the average level of PM2.5 is trending down in recent years, there are still frequent large spikes.

It is important to note that indoor air quality is directly affected by outdoor air pollution in the absence of air purifiers. In China, offices of government officials are required to meet the Government Office Space Standards issued by the National Development and Reform Commission. These standards require offices to be "simple, economical, applicable and resource-saving" and provide detailed standards for basic facilities such as lighting, cooling, and heating systems. Air purifiers are not included in the standard provisions in government offices. To the best of our knowledge, no such facilities exist in the CSRC meeting rooms, despite the December 2019 proposal by the National Health Commission to equip offices with indoor air purifiers.

3.3 Control variables

We control for a variety of characteristics that may affect IPO approval decisions. Considering that IPO firms must disclose their financial information at least three years before the review, we control for a company's financial performance three years prior to the review session, including total sales, leverage, net profit margin, current ratio, and the share of intangibles. Moreover, we use indicator variables to control for whether a firm is a state-owned enterprise (SOE) or a foreign-funded enterprise (foreign). Firm ownership and financial information are from WIND and CSMAR. Moreover, because many studies document that weather conditions affect high-stakes decisions and human behaviors (e.g., Saunders, 1993, Hirshleifer and Shumway, 2003, Loughran and Schultz, 2003, Dehaan et al., 2017, Heyes and Saberian, 2019, Li and Patel, 2021), we consider weather conditions on the review days by constructing two variables: average daily temperature and an indicator variable for whether it rained that day. All hourly city-level weather information is obtained from the meteorological station reports. In addition, we construct variables measuring review committee member characteristics such as gender, experience, full-time employee status at the CSRC, and postgraduate degrees. All variables are defined in Table 1.

3.4 Summary statistics

Table 2 presents the summary statistics of our study sample. Our main dependent variable is an indicator for a firm passing the IPO review (*1[Passing review]*), and the independent variable of interest is the air pollution level measured by hourly average PM2.5 level at the nearest monitoring station to the CSRC head office between 8:00 am and 6:00 pm on the review day (*PM2.5*). The average pollution level in Beijing on IPO review days during our sample period is 57 $\mu g/m^3$, more than 11 times the annual mean value worldwide at 5 $\mu g/m^3$, according to the World Health Organization. The maximum PM2.5 value is as high as 585 $\mu g/m^3$. Such severe air pollution would significantly affect the physical and mental health of human beings.

In Panel B, we present PM2.5 statistics from other parts of Beijing (PM2.5 of East, West, North, and South Beijing) and during non-working hours, between 8:00 pm and 12:00 am (night) and between 12:00 am and 5:00 am (dawn), as well as PM2.5 readings days before the review, and those from an adjacent city, Tianjin, which are used for falsification tests. We also show the PM2.5 level of the city where the IPO applicant is headquartered, which is significantly lower than that of Beijing. The evidence is consistent with the fact that Beijing is one of China's most polluted cities. The average temperature on review days is 13 degrees Celsius, and the average wind speed is 2.6 meters per second, a typical weather condition for northern China.

In Panel C, we report summary statistics of IPO firm characteristics. Average total assets of those listed firms are 16.5 billion RMB. There is a large variation in the size of the listed firms, with the largest firm's total assets at 9.5 trillion RMB and the smallest firm's assets at 150 million RMB. Overall, only 8% of firms are state-owned enterprises (SOEs), and 3.4% of firms have foreign ownership.

Panel D shows that during review sessions, the review committee asks on average 15.5 questions that cover 3.5 topics, averaging 4.4 questions for each topic. Some of the questions raised under the same topics are follow-up questions, requesting the applicants to clarify or complement their previous answers. Moreover, we find that a large share, 45%, of questions are relatively complex. Such questions are often related to firms' business risk and profit source. In Panel E, we present the characteristics of the review committee members. We find that the average age of these reviewers is 43.6, about a quarter are women, 88% are full-time employees of the CSRC, and over 81% have a bachelor's degree. They served an average of 1.5 terms as reviewers.

4 Air Pollution and IPO Review Outcomes

In this section, we first perform our baseline analysis that relates the probability of IPO approval to the level of air pollution on the review day. We then present a comprehensive set of robustness tests, including falsification tests and instrumental variable (IV) regressions using local wind speed

as an instrument for air pollution. Furthermore, we explore firm heterogeneity to investigate whether the effect of air pollution on IPO passing rate is more pronounced for firms operating in green versus polluting industries or firms with complex operations.

4.1 Baseline results

To investigate the impact of air pollution on the probability of a firm passing the IPO review, we conduct regressions with the following specification:

$$1[Passing\ review]_{i,t} = \beta PM2.5_{i,t} + \delta \mathrm{X}_{i,t} + \mu_s + \gamma_p + \theta_t + \eta_d + \lambda_c + \epsilon_{i,t} \quad (1)$$

$1[Passing\ review]_{i,t}$ is a dummy variable that equals one if the IPO applicant passes the review, and zero otherwise. $PM2.5_{i,t}$ represents the average hourly pollution level of PM2.5 on the day of the review session at the North Xizhimen station. We scale the PM2.5 value by 100 to help the interpretation of the coefficients. X_i is a variety of firm characteristics and committee composition control variables. μ_s and γ_p represent industry fixed effects and province fixed effects, respectively. They capture any IPO-related regulations that target firms in certain sectors or provinces. θ_t represents the calendar quarter fixed effects of the review session, capturing the time-varying economic and market conditions.[8] η_d represents day of the week fixed effects to control for unobservables that are related to information releases or committee member sentiment on specific working days (Dong et al., 2021). λ_c represents the committee chairman fixed effects. The chairman of the committee is usually a reputable official in the CSRC who plays a critical leadership role and enjoys disproportional power in shaping the final review decisions of the committee.[9]

[8]For instance, the government is not likely to approve new IPOs if the economic growth slows down or stock market value is low, with the concern that newly floated stocks would further decrease the index price.

[9]In untabulated statistics, we compare the characteristics of committee chairs and other members and find that compared with other members, committee chairs are more experienced (serving for longer terms on the committee), are more likely to work at the CSRC, are more likely to be female, and are more likely to have a bachelor's degree. Note that we cannot include committee fixed effects because committee members are randomly picked and thus are not fixed for each IPO review. In our robustness tests in Internet Appendix Table 6, we also include individual member fixed effects.

$\epsilon_{i,t}$ is the heteroscedasticity-adjusted residual term. The coefficient β measures the effect of air pollution on IPO success.

The key identifying assumption for our study is that the date for IPO review is not endogenously determined by the CSRC based on firm or review member characteristics, and the severity of air pollution on the day of their review cannot be predicted on the IPO assignment date. The identifying condition is satisfied in our setting based on the following observations. First, because the timing and the date of the IPO review are determined one week before the review date, the CSRC cannot predict whether there will be severe air pollution on the day of the review. Second, the review committee composition is randomly determined through a lottery system to ensure the homogeneous quality of the review team for each IPO, and thus there is no endogenous matching between committee member quality and air quality. Furthermore, committee members are typically not allowed to be absent on the day of the review.[10] Those conditions ensure that the pollution level does not capture unobservables related to committee quality. In addition, it is also unlikely that firms and underwriters could time the review date, which is determined solely by the CSRC. Even if the firms themselves decide to withdraw from the IPO process, the new review date is beyond their control. Nonetheless, we compare both firm characteristics and review member characteristics for IPOs reviewed on polluted days and clear days, and find no significant differences in those characteristics (see Internet Appendix Table 5).

Table 3 presents the baseline results. Column (1) shows that firms are more likely to pass the IPO review on polluted days than on clear days. Adding control variables and fixed effects does not change the economic scale of the results significantly, showing that the effect of PM2.5 on the pass rate is robust. The coefficient estimates in column (3) suggest that for every 100-point increase in PM2.5 concentration, the probability of passing IPO review increases by more than 4.6 percentage points. Among control variables, firms that are larger, more profitable, and have more intangibles are more likely to receive IPO approval. The IPO approval rate for the first-time

[10] In our sample, only two members requested a sick leave, 13 members took a leave for personal reasons, and 15 members excused themselves because of a conflict of interest (see Internet Appendix Table 4). The likelihood of a member's leave of absence is thus 0.3%, based on 1,488 IPO reviews with seven members assigned to each review.

review is lower on average. For committee member characteristics, IPO approval rate is higher when the committee has more part-time members or when members have more work experience.

To show the non-linear effects of pollution on IPO approval, we decompose review days into four groups according to air quality as classified by China's Ministry of Environmental Protection: good (<75 $\mu g/m^3$), lightly polluted (75–115 $\mu g/m^3$), heavily polluted (115–150 $\mu g/m^3$), and extremely polluted (>150 $\mu g/m^3$). We find that the passing rates on days when air quality is defined as lightly polluted are indistinguishable from the rates observed on the days when air quality is good (the omitted category) in column (4). The effect of air pollution on IPO approval is pronounced on heavily or extremely polluted days. The passing rates are 6.6 and 12.5 percentage points higher when air quality is heavily polluted and extremely polluted, respectively, than the passing rates on days with good air quality.

Figure 2 shows the positive relationship between PM2.5 and firm passing rate by year. Each dashed or dotted line in the figure represents the fitted line of the effect of air pollution on the passing rate for all IPO applicants within a year. The solid line in the middle represents the fitted line using all observations. Overall, there is a clear positive relation between air pollution level and the passing rate when air pollution levels are high by year, although the relation is stronger in some years than in others. The evidence helps mitigate the concern that the pollution–pass rate relation is driven by certain observations that are clustered over a short period of time.

4.2 Robustness tests

We conduct several robustness tests to address the concern that the relationship of PM2.5 and the probability of passing the review may be attributed to confounding factors. All robustness tests results are presented in Internet Appendix Table 6.

First, we control for committee employment period fixed effects to account for the possibility that there may be changes in the composition of the pool of review committee members between terms leading to shifts in regulatory standards and practices. Our results are almost identical to those in the baseline regressions after the inclusion of these additional fixed effects. Second, we

restrict our sample to IPOs on the Main Board while excluding those listed on the Growth Enterprise Market (GEM) and also run subsample analysis after excluding the introduction of the STAR market of the Shanghai Stock Exchange and find similar results. Third, because of considerable evidence that the strictness of listing standards is closely tied to the central government's macroeconomic policies (Cong and Howell, 2021), we run subsample analysis by excluding periods of economic stimulus, periods of intense pollution control, and the COVID-19 period, respectively, and find similar results. Fourth, because the likelihood of a company's IPO success may be significantly related to the personal preferences of review committee members and may also be influenced by seasonal factors, we control for the personal fixed effects of review committee members and find our results stay invariant. Fifth, our results are similar if we include calendar month fixed effects. Sixth, our results are robust to controlling for the pollution levels at the firm headquarters and firm headquarters fixed effects. Last, as political connections, particularly those of the company itself and the underwriters it employs are considered crucial factors in determining the IPO success (Chen et al., 2017), we control for the political connections of the company and its underwriters and find similar results.

We also conduct falsification tests using the PM2.5 concentration measured during non-working hours at the Xizhimen North monitoring station and the PM2.5 concentration in the nearby city of Tianjin (in Appendix Table 7). We find that neither of these factors affects the approval rate. These tests help us further mitigate the concern that PM2.5 measurements may capture some unobserved time- and region-specific heterogeneity that affects review outcomes. Another possibility is that companies approaching their review date might use the PM2.5 levels prior to the review meeting to predict the pollution levels on the review day, leading to strategic actions such as withdrawing their application or actively seeking favorable treatment through political connections. However, we believe this is unlikely. We plot the mean and the 99% confidence interval of the coefficient estimate for PM2.5 on the review day as well as on five lagged and five leaped days around the review date (i.e., from five days before to five days after the official review) in Figure 3. We find that only the coefficient for PM2.5 measured on the day of the review

session is significantly positive at the 1% level.[11] Additionally, after controlling for the PM2.5 levels on the announcement day of the IPO review, typically one week before the review, as well as the PM2.5 levels from 30 days prior to the review, we find that our results remain unaffected.[12]

4.3 Instrumental variables regressions

Despite showing that our results are robust to a rich set of additional tests in the last section to address the endogeneity concerns, we cannot exhaust all possibilities. We take a different approach in this section. We follow prior studies (Bondy et al., 2020, Li et al., 2021) to use the natural logarithm of local wind speed as an instrumental variable (IV) for the severity of air pollution. The intuition is that a strong wind can effectively dilute the pollutant density in the air, thereby decreasing the PM2.5 level. When compared to other weather conditions, such as rain and snow, wind is plausibly the most effective in decreasing local pollution, and importantly, wind speed satisfies the exclusion restriction. Because wind speed is mainly determined by meteorological factors, it is unlikely to affect the firms' IPO review through channels other than PM2.5, as the committee memberships are determined a week prior to review, and it is extremely hard, if at all possible, to predict wind speed at that time.[13]

We use the following set of equations for our regression analysis:

$$PM2.5_{i,t} = \beta_0 lnWindspeed_{i,t} + \beta_1 lnWindspeed_{i,t-1} + \delta X_{i,t} + \mu_s + \gamma_p + \theta_t + \eta_d + \lambda_c + \epsilon_{i,t} \quad (2)$$

$$1[Passing\ review]_{i,t} = \beta \hat{PM2.5}_{i,t} + \delta \mathrm{X}_{i,t} + \mu_s + \gamma_p + \theta_t + \eta_d + \lambda_c + \omega_{i,t} \quad (3)$$

[11] The autocorrelation of the air pollution between the review date, one day before, and one day after the established review day is about 0.4. The correlation between PM2.5 on the review day and on days at least two days before the review is zero (see Internet Appendix Figures 2 and 3).

[12] Our results should not be driven by air pollution's impact on attendees (i.e., the management team and underwriters who attend review sessions) because one would observe a lower approval rate on polluted days. Nonetheless, we leverage the use of online review sessions after COVID-19 (i.e., reviewers remained at the CSRC in Beijing while attendees joined from their own cities virtually for the review sessions) to show that the effects of PM2.5 on review outcomes did not significantly change after this shift (Internet Appendix Table 8).

[13] To verify this intuition, we check the correlation between wind speed and a variety of firm- and committee-level characteristics, such as a firm's profitability and size, and a committee member's work experience at the CSRC, education, and professional background. Not surprisingly, all characteristics have a low and insignificant correlation with the wind speed on the review day and the day before.

In the above specification, $\text{lnWindspeed}_{i,t}$ is the natural logarithm of the average wind speed during the working hours of the review day. $\text{lnWindspeed}_{i,t-1}$ is the natural logarithm of the average wind speed during the working hours of the day before the review day. Note that the wind speed for the prior day can be relevant for the air pollution level the next day, as wind clears away most pollutants and interrupts the accumulation process of those pollutants. We therefore include wind speed on both days. We also use the natural logarithm of the average wind speed on both days as an alternative instrument.

The first-stage result of the instrumental variable regression is reported in column (1) of Table 4. We find that the PM2.5 level decreases by $11.1\mu g/m^3$ with one standard deviation increase in the wind speed on the review day. The PM2.5 level decreases by $17.8\mu g/m^3$ for one standard deviation increase in wind speed the day before the review. The F-statistic is more than 23, much greater than the rule-of-thumb level of 10, suggesting that the weak instrument problem is not a major concern in our setup. In column (3), we use the average wind speed of the review day and the day before as an instrument and find similar results. Using wind speed on the day of review and one day prior as an instrument, in columns (2) and (4), we find that the coefficient for PM2.5 is positive and significant, and of an even larger economic scale. The IV estimation further confirms our baseline result.

Overall, our results show strong evidence that IPOs are more likely to be approved on polluted days than on clear days. In the next section, we explore the mechanisms through which air pollution affects the decisions of review committee members.

4.4 Exploring mechanisms

Our main analysis shows that the worsening of air quality significantly affects review outcome, likely through its impact on the behavior and decision quality of the committee members. Our results are consistent with the interpretation that the review committee's decision-making is affected on polluted days because of the effects of air pollution on reviewers' cognitive capability (Chang et al., 2019, Huang et al., 2020). The evidence is less consistent with air pollution impos-

ing psychological pressure and depressing an individual's mood (Fonken et al., 2011, Dong et al., 2021), which should prompt reviewers to reject more IPO applications, leading to lower passing rates. In this section, we perform three sets of tests using firm heterogeneity and textual analysis of the review transcripts, respectively, to further pin down the cognitive capability channel.

4.4.1 Firm heterogeneity: Salience effect

One explanation for the increase in the applicants' passing rate during polluted days reflects the salience effect that can be a direct result of cognitive limitations of the reviewers (Bordalo et al., 2013, Cosemans and Frehen, 2021). On hazy days, reviewers may be more likely to perceive the harm of air pollution and therefore become more stringent (lenient) toward firms in polluting (green) industries despite pollution on the review day, adding no new information on the overall negative effect of pollution. Such a tilt in the perceived effect of air pollution may directly affect the IPO approval decision.[14] For our analyses, we first include the interaction of PM2.5 and an indicator variable for the polluting or green industry in our baseline specification to examine whether the effects are stronger for firms in those industries. Specifically, we run the following OLS regression:

$$\begin{aligned} 1[Passing\ review]_{i,t} = \beta_1 PM2.5_{i,t} + \beta_2 \text{Key indicator} + \beta_3 PM2.5_{i,t} \times \text{Key indicator} \\ + \delta X_{i,t} + \mu_s + \gamma_p + \theta_t + \eta_d + \lambda_c + \epsilon_{i,t} \end{aligned} \tag{4}$$

Key indicator captures whether the firm is in a polluting (or green) industry; $X_{i,t}$, μ_s, γ_p, θ_t, η_d, and λ_c capture the same set of control variables and fixed effects as in our baseline regression.

The polluting industry categorization is from the "Environmental Protection Verification of Listed Companies" issued by the Ministry of Ecology and Environment of China. The following industries are defined as heavy polluting industries: mining, quarrying, and oil and gas extraction; textiles, leather, fur, feather, and their products; shoes; paper and paper products; oil pro-

[14] While the industry fixed effects could capture the level differences of polluting and green industries on the passing rate in the baseline regressions, the specifications do not capture the incremental effects of air pollution on firms in different industries.

cessing and cooking; nuclear fuel processing; chemical raw materials and chemical products manufacturing; chemical fibers; rubber and plastic products; non-metallic mineral products; ferrous metal smelting and rolling; non-ferrous metal smelting and rolling; electric power and heat. The green (or environmental) industries include the following sectors: ecological protection and environmental management; research and experimental development; science and technology and application services; professional technology services; waste management; building decoration; and other construction industries.

Table 5 presents the results. We first find that the coefficient of PM2.5, the main independent variable of interest, stays quantitatively the same compared with the baseline result. Importantly, the coefficients of the interaction for polluting (green) industries are negative (positive), and statistically significant at the 5% level. The evidence shows that firms in green industries are more likely to have their IPOs approved when PM2.5 is high on the review day while IPOs of firms in polluting industries are more likely to be rejected when PM2.5 is high. A balance test (in Internet Appendix Table 5) mitigates the concern that the results are driven by the match between the timing of pollution and the industry of the reviewed firm. The evidence suggests that air pollution on the review day may intensify reviewers' perception of the hazardous effects of air pollution on health, causing review members to reject or approve firms with certain characteristics related to air pollution. The phenomenon reflects potential salience biases of review members that can intensify as a result of a reduction in cognitive ability.

4.4.2 Firm heterogeneity: Firm complexity

We examine heterogeneity in firm's complexity of operations to further pin down the cognitive capacity channel. Firms that have complex operations are harder to evaluate and require more in-depth analysis by the committee members than less complex firms. As a result, the cognitive capacity of committee members is particularly important for evaluating those firms.

We adopt three measures for firm complexity. The first measure is whether a firm is active in innovation. Specifically, a firm is regarded as complex if it has positive R&D expenses (Brick

et al., 2006). Second, following Cohen and Lou (2012), we treat firms operating in more than one industry segment as complex firms. In fact, firms that operate in two or more industries represent approximately 25% of our sample. Third, using similar measures, we treat those firms that operate in more than 12 cities, the 75th percentile in our sample, as the third measure for complexity.

We perform the same specification by interacting PM2.5 and firm complexity measures, as in Equation (4). Table 6 presents the results. We find that more complex firms have lower passing rates on average. However, their passing rates are much higher on polluted days. The evidence suggests that the reviewers, with reduced cognitive capacity on high PM2.5 days, are less capable of conducting in-depth analysis on complex firms and, as a result, are more likely to approve their IPO applications.[15]

4.4.3 Analyzing the review session transcripts

To provide direct evidence on the reduced cognitive capacity of reviewers, we analyze questions raised by the review members during the review session. We obtain transcripts of all available review sessions between February 2015 and December 2020 from the CSRC website. We count the total number of questions, including both main questions and follow-up questions, raised during each session. We measure the average length of questions based on the number of characters. We then apply latent Dirichlet allocation (LDA), an advanced textual analysis technique that extracts underlying topics in a set of documents according to the estimated distribution and correlation of words, to categorize the topic of each individual question. Internet Appendix A provides a detailed description.

We categorize all questions into eight main topics according to the keywords identified (see Internet Appendix Table 1). We then sort the eight topics into two major groups: complex and (simple) intuitive questions, according to Zhang et al. (2020). Complex questions require the

[15]In untabulated results, we explore review member characteristics to identify those individuals on whom air pollution has the most severe impact on their cognitive ability. We find that the passing rate is higher on polluted days if reviewers are not from Northern China (i.e., those who are less adapted to air pollution (Dong et al., 2021)), or if they are older, who are more sensitive to air pollution, probably due to preexisting conditions related to respiratory systems (Zhang et al., 2018).

reviewers to think deeply about the quality and development prospects of the company, including business risk, profitability, shareholders, and related transactions. Intuitive questions, on the other hand, do not require in-depth thinking, and include simple inquiries based on existing information, such as accounts receivable, main business, and accounting standards. Moreover, raising follow-up questions on the spot requires committee members to stay sharp and make judgments during the review session. As a result, air pollution that impairs committee members' mental conditions could significantly affect the number of follow-up questions raised and thus the review results.

Table 7 presents our findings. Column (1) shows that the total number of questions decreases during polluted days. The length of questions also decreases, as shown in column (2). More importantly, columns (3) and (4) show that the results are driven by the decreases in the number of follow-up questions within each topic, rather than the total number of topics. The evidence reflects the deterioration of cognitive conditions of the reviewers, as the follow-up questions, instead of the topics, rely more on improvisation than preparation. Moreover, in the last two columns, we find that the share of complex questions requiring serious thought decreases, indicating that the reviewers are less capable of processing complicated information when air pollution is severe. The findings show strong evidence that reviewers' cognitive capability is negatively affected by air pollution.[16]

5 Implications for the IPO Review System

Our results demonstrate that firms are more likely to pass their review and float their stocks on polluted days than on non-polluted days due to the reduced cognitive capacity of reviewers. However, the implication of our findings for the efficiency of China's review system remains unclear.

[16]We also present evidence that the above measures on the number and length of questions are directly related to the passing rate of the review. Internet Appendix Table 9 shows that the number of questions and the share of complex questions raised during the review session significantly decrease the pass rate of IPO review. The evidence suggests that our baseline results of a higher pass rate could be attributed to changes in questions due to members' air pollution exposure.

On the one hand, the reduced productivity of the review committee on polluted days may lead to the approval of IPOs that should not be approved (i.e., error arising from failure to reject “bad" IPOs). On the other hand, the CSRC review committee may be subjectively harsh on approving IPOs on average and thus over-reject “good” IPOs on non-polluted days (Qian et al., 2022). A higher approval rate as a result of air pollution helps marginal firms raise capital to fund their investments. Although it is empirically challenging to clearly identify which effect dominates, we perform several tests in this section to provide suggestive evidence that air pollution, in fact, helps more qualified Chinese firms to get listed. Specifically, we examine post-IPO stock returns and accounting performance between firms that are approved on polluted days and those on non-polluted days, compare firm characteristics of those that are rejected by the review committee and those that are approved by the review committee after a second round of review, and finally, investigate the interactive effects of political connection and review outcomes.

5.1 Post-IPO performance and second reviews

To shed light on the average quality of firms that receive IPO approval on polluted days versus on non-polluted days, we first examine their post-IPO stock and accounting performance. We measure stock performance using the market-adjusted buy-and-hold abnormal return (BHAR), which is calculated as the difference between an IPO firm’s raw buy-and-hold return and the return of the Shanghai Shenzhen Composite 300 Index.

Figure 4 presents the stock performance in the first year after IPO. We observe that IPOs approved on polluted days and those approved on non-polluted days exhibit remarkably similar stock performance. Table 8 shows the BHAR between firms that are approved on days with above-median PM2.5 level and those approved on days with below-median levels in different time windows. We find that BHARs between the two groups of firms over various time periods after IPO are neither statistically nor economically different.

We next explore whether there are heterogeneous differences in stock returns by firms characteristics using the following OLS regression:

$$\begin{aligned} Y_{i,t} = \beta_1 PM2.5_{i,t} + \beta_2 \text{Key indicator} + \beta_3 PM2.5_{i,t} \times \text{Key indicator} \\ + \delta X_{i,t} + \mu_s + \gamma_p + \theta_t + \eta_d + \lambda_c + \epsilon_{i,t} \end{aligned} \tag{5}$$

$Y_{i,t}$ represents 1-year BHAR. *Key indicator* captures firm industry and firm complexity measures used in Tables 5 and 6; $X_{i,t}$, μ_s, γ_p, θ_t, η_d, and λ_c capture the same set of control variables and fixed effects as in our baseline regression. We examine whether firms in green or polluted industries or more complex firms perform differently if they pass the IPO review on hazy days. If the evidence that firms in green industries and complex firms are more likely to have their IPOs approved on polluted days is a manifestation of qualified firms floated, we expect to observe no difference in stock performance between green firms and non-green firms (or between complex and non-complex firms) approved on polluted days. In contrast, if low quality green (or complex) firms are floated on polluted days, we expect those firms to experience worse performance. The results are presented in Panel A of Table 9. We find that the coefficients for air pollution and the interaction terms are statistically insignificant in all columns, suggesting that IPOs of firms in green industries and complex firms approved on polluted days do not exhibit different post-IPO performance than other firms do.

In addition, we examine firm-level accounting performance. We use the three-year average post-IPO EBITDA-to-sales ratio as our baseline measure, and the results are presented in Panel B of Table 9. In Internet Appendix Table 10, we also adopt net profit margin, ROA, and EPS as robustness tests. In all columns, we find that the coefficients for air pollution are neither statistically nor economically significant, showing that IPOs approved on polluted days and non-polluted days do not differ in their accounting performance. Moreover, the statistically insignificant interaction terms show that the set of firms (i.e., green firms and complex firms) that are more likely to pass their IPO approval on polluted days do not differ in performance than other firms.

A caveat for our post-IPO performance analysis is that we can only observe the performance of approved IPOs, not those that were rejected. Nonetheless, we are able to observe the financial performance of firms whose IPO applications are initially rejected by the review committee but approved in a second attempt, shortly after the rejection. In Panel A of Table 10, we compare characteristics of IPOs at the time of their first review with a rejection outcome and at the second review that led to an approval. We find that the firm characteristics such as profitability and leverage ratios are remarkably similar. The evidence is not surprising given that the vast majority of companies apply for a second review shortly after failing the first one in order to avoid the substantial costs of completely updating their financial statements, which is required if the process is delayed for more than a year. That is, the initially rejected company's financial statements remain largely unchanged between the two reviews yet the review outcomes differ. Moreover, Panel B shows that the composition of review committee members looks similar between the two reviews. The evidence further demonstrates that ultimate success of an IPO largely relies on the review committee's decision, which can be biased and disentangled from firm fundamentals.

The evidence together suggests that the approved IPOs on polluted days that would otherwise be rejected on non-polluted days are likely those firms that should have been floated regardless of air pollution. The evidence is consistent with review committee over-rejecting high quality IPOs on non-polluted days, while air pollution in fact helps mitigate the distortions.

5.2 Firms' political connections

The literature has suggested that the Chinese IPO review system, characterized by its lack of transparency and reliance on human decisions, tends to favor politically connected firms over those without such ties (Fan et al., 2007, Chen et al., 2017, Qian et al., 2022). Politically connected companies can leverage their connections to influence the decisions of the review committee members, granting those firms a higher priority for approval under otherwise similar conditions. In contrast, firms without political connections may become targets for scrutiny: despite having the same qualifications, they are more likely to face tough questions that hinder their success to

listing. However, such scrutiny may be less effective during periods of high pollution, as the review committee members face lower cognitive capacity, making it harder for them to devise challenging questions to reject firms without political connections, benefiting those firms without political ties.

In this section, we explore whether higher passing rates on polluted days are manifestations of higher likelihood of review committees approving firms that are not politically connected. We follow Fan et al. (2007) to measure a firm's political connection by whether its CEO was currently or formerly an officer of either the central government or a provincial government. Such information was collected from the CSMAR database. We define three indicators on whether a CEO is not politically connected: $1[Non{-}Connection]$, which takes on the value of one if a CEO is not connected with either the central government or provincial government; $1[Non-CentralConnection]$, which takes on the value of one if a CEO is not connected with the central government; and $1[Non{-}CurrentCentralConnection]$, which takes on the value of one if a CEO is not currently connected with either the central government or provincial government. We use similar regression specification as in Equation (4). Table 11 presents the results.

We first find that consistent with prior studies, companies without political connections have lower passing rates on average. Specifically, IPOs of firms without political connections are 16%–21% less likely to be approved on non-polluted days. Importantly, the positive coefficient for the interaction term indicates that air pollution, in fact, helps improve the passing rates of non-connected firms. The effect is strongest for firms not having the CEO serving as a government official at the time of the review. These findings suggest that some non-connected firms are able to bypass the stringent review and successfully list their stocks due to air pollution.

6 Conclusion

In this paper, we use China's initial public offering approval system as a unique setting to study the unintended consequences of the impact of transitory fine particulate air pollution on high-stakes decision-makers in the financial system. We find that the IPO approval rate on hazy days

in Beijing is five percentage points higher than on clear days. The results are robust to a number of alternative specifications and subsample tests. To help further pin down the cognitive capacity channel, we first perform firm-heterogeneity tests to show that environmentally friendly firms are more likely to receive IPO approval on polluted days. The evidence reflects the salience effect that can be a direct result of the cognitive limitations of the reviewers. We also find that IPOs of complex firms are more likely to be approved on clear days than on polluted ones. Moreover, we perform textual analysis of review questions and show that on polluted days, reviewers ask fewer, shorter, and less complex questions, and they are less likely to ask follow-up questions. Examining the post-IPO performance, we find that IPOs approved on polluted days have similar stock returns and operating performance with those approved on clear days. Importantly, although firms without political connections are less likely to obtain approval, they are more likely to pass the review on polluted days.

Our results suggest that air pollution has an effect on the cognitive ability of financial regulators, while at the same time not facilitating low-quality firms to go public. Our findings highlight an important channel through which air pollution has real effects on investors and financial markets, which has implications for the financial markets of many countries that still suffer from severe air pollution. Our study suggests that despite the negative effect of air pollution on the cognitive capability of high-stakes decision-makers in the financial system, the unintended economic outcomes may not be overly negative in a system that is subject to the discretion and biases of government agents.

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Figure 1: Monthly Average Level of PM2.5 at Xizhimen Monitoring Station

This figure shows the monthly distribution of daily level of PM2.5 during working time at Xizhimen station, the closest station to the CSRC. The whiskers show the range of values during each month.

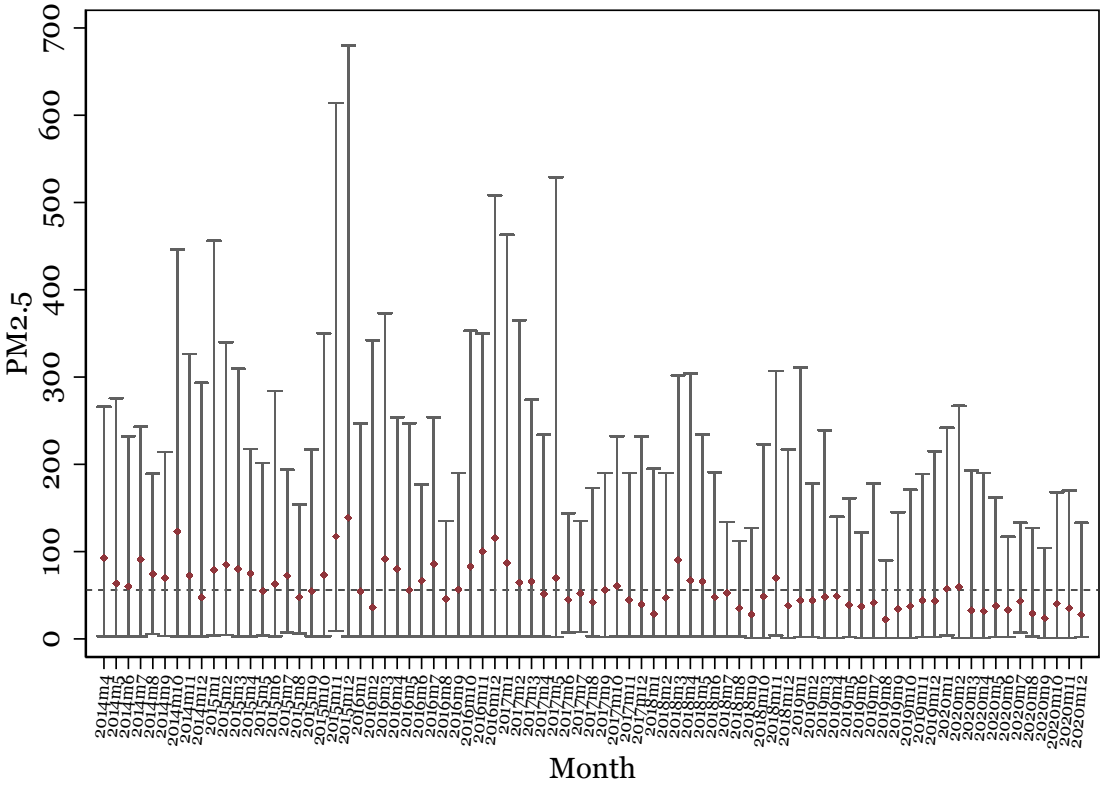


Figure 2: Annual Correlation of PM2.5 and IPO Passing Rate

This figure shows the correlation of PM2.5 and pass rate from 2014 to 2020.

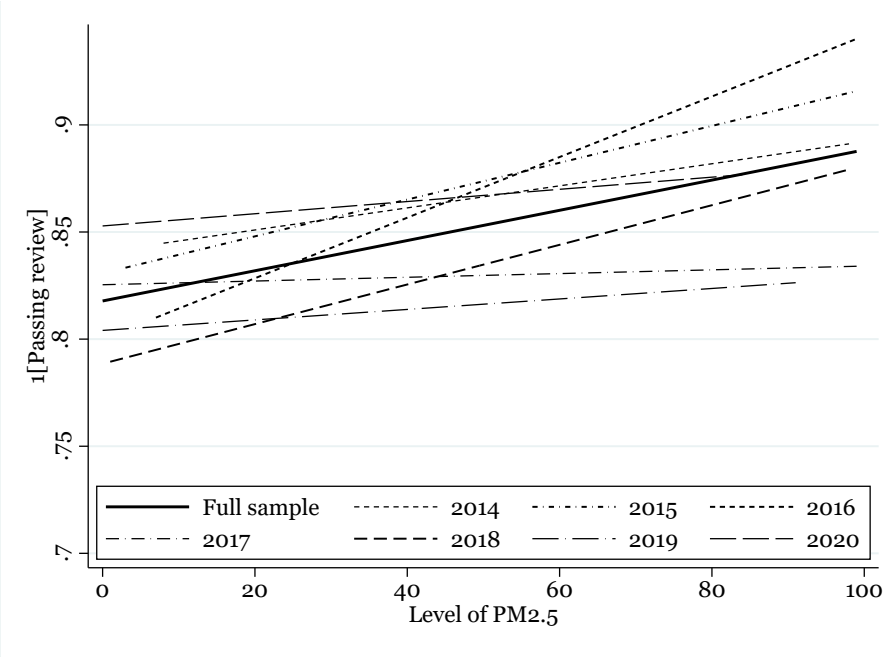


Figure 3: Dynamic Effects of PM2.5

This figure shows how the coefficient estimates of PM2.5 vary with the number of days relative to the conference. Each point indicates the point estimate including the full set of controls and lead and lagged PM2.5 levels. The whiskers show the 99% confidence interval of each coefficient estimate.

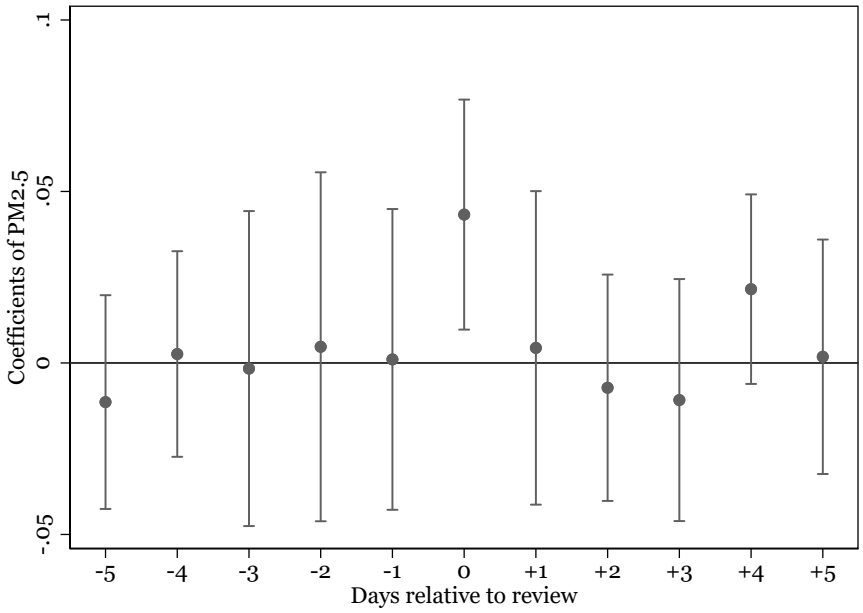


Figure 4: Post-IPO Stock Performance

The figure shows the average buy-and-hold return adjusted by market index by pollution groups.

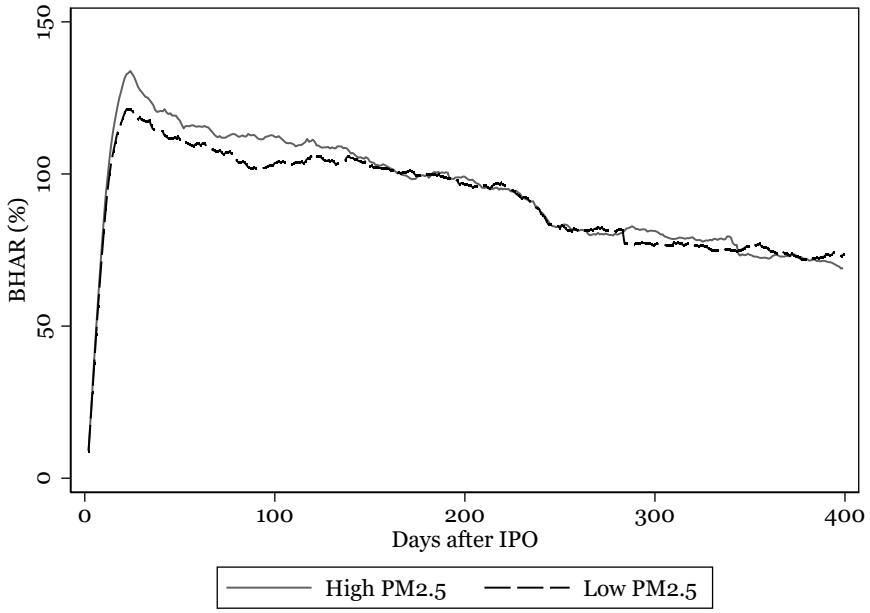


Table 1: Variable Definitions

This table presents definitions of all variables used in the analysis.

Variables:	Description
	Panel A. Key variables
1[Passing review]	1 if firm passes the approval of IPO
PM2.5	Level of PM2.5 around CSRC during working time 8:00-18:00 ($\mu g/m^3$)
	Panel B. Air pollution and weather
PM2.5_night	Level of PM2.5 around CSRC during night 20:00–24:00 ($\mu g/m^3$)
PM2.5_dawn	Level of PM2.5 around CSRC during dawn 0:00–5:00 ($\mu g/m^3$)
PM2.5_Firm	Level of PM2.5 in firm's registration city during working time ($\mu g/m^3$)
PM2.5_announcementday	Level of PM2.5 on the day when the review is assigned, within a week before the review
PM2.5_randomday	Level of PM2.5 30 days before the review
PM2.5_Tianjin	Level of PM2.5 in Tianjin, a city close to Beijing
Temperature	Temperature around CSRC during working time (degrees Celsius)
1[Rain]	1 if precipitation is larger than 0 around CSRC
Windspeed	Wind speed around CSRC during working time (m/s)
	Panel C. Firm characteristics
Assets	Average total assets within 3 years prior to the meeting (billion RMB)
Sales	Average total sales within 3 years prior to the meeting (billion RMB)
Profitability	Average net profit margin 3 years prior to the meeting
Leverage	Average leverage ratio within 3 years prior to the meeting
Intangibles	Average intangibles ratio within 3 years prior to the meeting
CurrentRatio	Average current ratio within 3 years prior to the meeting
1[SOE]	1 if firm is state-owned
1[Foreign]	1 if firm is foreign-owned
1[FirstReview]	1 if firm is reviewed by committee for the first time
1[Polluting industries]	1 if firm industry is heavily polluting defined by the Ministry of Ecology and Environment of China
1[Green industries]	1 if firm industry is environmentally friendly
1[R&D expense >0]	1 if firm has positive capital expenditure prior to the meeting
1[>=2 industry sectors]	1 if firm operates in more than one industry sectors
1[>=12 operating cities]	1 if firm has subsidiaries in more than 12 cities
1-year BHAR	Market-adjusted buy-and-hold abnormal return 1 year after listing
EBITDA/Sales	Average EBITDA-to-sales ratio in 3 years after listing
1[Non-Connection]	1 if the firm is not politically-connected, i.e. its CEO is not currently or formerly a government officer.
1[Non-Central Connection]	1 if the firm CEO is not currently an officer of the central government.
1[Non-Current Central Connection]	1 if the firm CEO is not currently or formerly an officer of the central government.
	Panel D. Questions raised at the meeting
Total number of questions	Total number of questions
Length of questions	Total number of Chinese characters of questions
Number of topics	Number of paragraphs of questions, usually each paragraph a separate topic
Number of follow-up questions per topic	Calculated by Total number/Number of topics
1[Complex > Intuitive questions]	1 if there are more complex questions than intuitive questions in a review meeting. Complex and intuitive are defined by question topics generated by LDA topic model.
Complex questions (%)	Percentage of complex questions in a review meeting
	Panel E. Member characteristics
1[Female]	1 if member is female
1[Fulltime]	1 if member is a full-time CSRC employee
1[Bachelor]	1 if member has at least a bachelor degree
Experience	Term of the member
Age	Age of the member.

Table 2: Summary Statistics

This table presents summary statistics of all variables used in the analysis. All variables are defined in Table 1.

Variables:	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(50)	Pctl(75)	Max
Panel A. Key variables								
1[Passing review]	1,488	0.851	0.356	0	1	1	1	1
PM2.5	1,488	56.8	62.0	3.0	17.5	36.7	74.2	584.9
Panel B. Air pollution and weather								
PM2.5_night	1,488	74.4	86.7	2.0	23.7	48.3	92.0	605.3
PM2.5_dawn	1,488	66.7	78.2	3.0	19.6	43.8	82.1	620.0
PM2.5_Firm	1,116	43.1	34.4	3.7	20.3	33.6	53.5	329.5
PM2.5_announcementday	1,488	63.1	69.2	2.0	18.0	40.0	92.0	605.0
PM2.5_randomday	1,488	56.93	56.28	1.0	16.0	39.0	76.0	605.0
PM2.5_Tianjin	1,389	61.2	53.0	6.2	24.2	48.2	82.4	381.1
Temperature	1,488	13.120	11.470	–12.230	1.723	14.390	24.180	34.150
1[Rain]	1,488	0.275	0.447	0	0	0	1	1
Windspeed	1,488	2.640	1.307	0.727	1.727	2.364	3.182	8.364
Panel C. Firm characteristics								
Assets (in Billion RMB)	1,488	16.5	258.9	0.149	0.478	0.834	1.573	9532
Sales (in Billion RMB)	1,488	1.6	9.9	0.042	0.262	0.513	1.054	295
Profitability	1,488	0.155	0.116	–0.073	0.085	0.130	0.201	1.133
Leverage	1,488	0.415	0.209	0.000	0.272	0.403	0.535	1.000
Intangibles	1,488	0.049	0.051	0	0.014	0.039	0.067	0.524
CurrentRatio	1,488	2.325	2.324	0.000	1.280	1.777	2.633	42.000
1[SOE]	1,488	0.080	0.271	0	0	0	0	1
1[Foreign]	1,488	0.034	0.182	0	0	0	0	1
1[FirstReview]	1,488	0.947	0.224	0	1	1	1	1
1[Polluting industries]	1,488	0.176	0.381	0	0	0	0	1
1[Green industries]	1,488	0.073	0.261	0	0	0	0	1
1[R&D expense >0]	1,488	0.097	0.297	0	0	0	0	1
1[>=2 industry sectors]	1,488	0.355	0.479	0	0	0	1	1
1[>=12 operating cities]	1,488	0.315	0.465	0	0	0	1	1
1-year BHAR	1,071	0.846	1.451	-1.627	0.043	0.507	1.257	22.590
EBITDA/Sales	1,203	0.446	0.487	-0.730	0.209	0.340	0.529	8.348
1[Non-Connection]	1,488	0.572	0.495	0	0	1	1	1
1[Non-Central Connection]	1,488	0.763	0.426	0	1	1	1	1
1[Non-Current Central Connection]	1,488	0.857	0.350	0	1	1	1	1
Panel D. Questions raised at the meeting								
Total number of questions	1,254	15.870	8.054	0	9	16	23	37
Length of questions	1,254	786.9	379.3	0	467	793	1,071	2,107
Number of topics	1,254	3.554	1.231	0	3	4	5	8
Number of follow-up questions	1,253	4.451	1.820	0.750	3	4.500	5.667	14.500
1[Complex > Intuitive questions]	1,253	0.347	0.476	0	0	0	1	1
Complex questions (%)	1,253	0.451	0.287	0	0.250	0.500	0.667	1
Panel E. Member characteristics								
1[Female]	9,024	0.247	0.432	0	0	0	0	1
1[Fulltime]	9,024	0.879	0.326	0	1	1	1	1
1[Bachelor]	9,024	0.810	0.393	0	1	1	1	1
Experience	9,024	1.512	0.735	1	1	1	2	3
Age	4,200	43.590	3.785	37	41	44	46	55

Table 3: Baseline Results

This table presents the baseline regression results. The dependent variable takes the value of one if the review decision on an IPO review is passed and zero otherwise. PM2.5 is the level of PM2.5 around the CSRC headquarters (scaled by 100). Column (1) presents the results with no controls or fixed effects. Columns (2) and (3) include control variables, as well as industry, province, calendar quarter, day of week, and committee chairman fixed effects. Column (4) includes dummy variables within groups of PM2.5. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]				
		Controls	Fixed effects	Pollution intensity
	(1)	(2)	(3)	(4)
PM2.5	0.049***	0.048***	0.046***	
	(0.012)	(0.010)	(0.009)	
PM2.5 (75-115)				0.013
				(0.026)
PM2.5 (115-150)				0.066***
				(0.024)
PM2.5 (>150)				0.125***
				(0.033)
lnSales		0.071***	0.064***	0.063***
		(0.011)	(0.010)	(0.010)
Profitability		0.530***	0.675***	0.669***
		(0.123)	(0.131)	(0.131)
Leverage		0.017	0.088	0.086
		(0.057)	(0.058)	(0.057)
Intangibles		0.925***	0.814***	0.797***
		(0.198)	(0.143)	(0.142)
CurrentRatio		-0.001	-0.002	-0.002
		(0.005)	(0.004)	(0.004)
1[SOE]		-0.097***	-0.035	-0.034
		(0.026)	(0.027)	(0.027)
1[Foreign]		0.002	-0.027	-0.028
		(0.042)	(0.038)	(0.038)
1[FirstReview]		-0.034	-0.098***	-0.097***
		(0.025)	(0.023)	(0.023)
Temperature		-0.002	0.002	0.002
		(0.002)	(0.001)	(0.001)
1[Rain]		0.150***	0.025	0.023
		(0.048)	(0.016)	(0.016)
1[Female]_mean		0.016	-0.000	-0.002
		(0.032)	(0.041)	(0.040)
1[Fulltime]_mean		-0.396***	-0.216*	-0.215*
		(0.114)	(0.117)	(0.118)
1[Bachelor]_mean		0.026*	-0.020	-0.019
		(0.015)	(0.014)	(0.014)
Experience_mean		0.177***	0.083***	0.084***
		(0.031)	(0.023)	(0.023)
Industry FE			Y	Y
Province FE			Y	Y
Quarter FE			Y	Y
Day of week FE			Y	Y
Chairman FE			Y	Y
Observations	1,488	1,488	1,488	1,488
Adjusted R^2	0.00659	0.172	0.357	0.357

Table 4: Instrumental Variable Regressions

This table presents the result from instrumental variable (IV) regressions. $ln(Windspeed_t)$ and $ln(Windspeed_{t-1})$ are natural logarithms of the wind speed on review day and the wind speed on the day before the review, respectively. Columns (1) and (2) use both $ln(Windspeed_t)$ and $ln(Windspeed_{t-1})$ as instrumental variables, and columns (3) and (4) use the natural logarithm of average value of current and lagged wind speed ($ln(AverageWindspeed)$). All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Instrument variables	$ln(Windspeed_t)$ & $ln(Windspeed_{t-1})$		$ln(AverageWindspeed)$	
	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)
$ln(Windspeed\_t)$	-0.274***			
	(0.067)			
$ln(Windspeed\_t-1)$	-0.438***			
	(0.073)			
$ln(AverageWindspeed)$			-0.682***	
			(0.101)	
PM2.5		0.077***		0.089***
		(0.030)		(0.032)
F-stat	23.801***		45.568***	
Observations	1,488	1,488	1,488	1,488
Adjusted R^2	0.293	0.033	0.288	0.029

Table 5: Heterogeneous Effects by Firms' Industries

This table presents the result of heterogeneity analysis by IPO firms' industries. Columns (1)–(2) show the effect on firms from polluting industries, and columns (3)–(4) show the effect on those from environmentally friendly (i.e., green) industries. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]				
Key Indicator:	1[Polluting industries]		1[Green industries]	
	(1)	(2)	(3)	(4)
PM2.5	0.046***	0.051***	0.046***	0.040***
	(0.009)	(0.010)	(0.009)	(0.008)
Key Indicator	-0.001	0.026	-0.019	-0.086
	(0.021)	(0.030)	(0.067)	(0.081)
PM2.5 * Key Indicator		-0.054**		0.151**
		(0.026)		(0.065)
Observations	1,488	1,488	1,488	1,488
Adjusted R^2	0.355	0.355	0.355	0.357

Table 6: Heterogeneous Effects by Firm Complexity

This table presents heterogeneous effects by firm complexity. Column (1) measures complexity with R&D expense of firms. Columns (2)–(3) define complex firms as those operating in more industry sectors or cities than 75% of the listed sample. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year, reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]			
Key Indicator:	1[R&D expense>0]	1[≥ 2 industry sectors (p75)]	1[≥ 12 operating cities (p75)]
	(1)	(2)	(3)
PM2.5	0.036***	0.030**	0.031***
	(0.009)	(0.012)	(0.009)
Key Indicator	-0.406***	-0.134***	-0.179***
	(0.072)	(0.021)	(0.035)
PM2.5 * Key Indicator	0.125**	0.047**	0.047**
	(0.063)	(0.018)	(0.022)
Observations	1,488	1,488	1,488
Adjusted R^2	0.423	0.375	0.390

Table 7: Analysis of Review Questions

This table shows how pollution affects the number, type, and complexity of inquiry questions raised during the meeting. Columns (1)–(4) discuss the impact on the number and length of questions, and (5)–(6) show the complexity. The variable definitions are listed in Table 1. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Total number of questions	Length of questions	Number of topics	Number of follow-up questions per topic	1[Complex > Intuitive questions]	Complex questions (%)
	(1)	(2)	(3)	(4)	(5)	(6)
PM2.5	-0.544*	-38.851***	-0.022	-0.141**	-0.054**	-0.029***
	(0.286)	(11.389)	(0.061)	(0.057)	(0.021)	(0.010)
Observations	1,251	1,251	1,251	1,250	1,250	1,250
Adjusted R^2	0.560	0.560	0.560	0.560	0.087	0.075

Table 8: Post-IPO Stock Performance

This table shows the average stock return difference between stocks that are reviewed on Low and High pollution days. Low pollution is defined as 1 if PM2.5 is below both the median for that year and that for sample average. The number of observations for characteristics of firms reviewed on Low and High pollution days are 807 and 681, respectively. The definitions of variable are listed in Table 1.

	Low Pollution	*High Pollution*	*Diff (Low-High)*	*p-value*
BHAR_1d	0.089	0.093	-0.003	0.146
BHAR_1m	1.201	1.315	-0.114	0.135
BHAR_3m	1.101	1.158	-0.056	0.490
BHAR_6m	1.043	1.087	-0.045	0.600
BHAR_1yr	0.821	0.834	-0.013	0.883
BHAR_2yr	0.738	0.641	0.097	0.271
BHAR_3yr	0.921	0.893	0.028	0.867

Table 9: Post-IPO performance

This table presents firms' post-IPO stock and financial performance. The dependent variable in Panel A and B are the firm's market-adjusted buy-and-hold abnormal return in 1 year after listing, and the average EBITDA ratio in 3 years after listing, respectively. Column (1) shows the baseline results. Columns (2)–(3) show performance by firm's industry as in Table 5, and columns (4)–(6) show performance by firm complexity as in Table 6. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year, reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Dependent variable: 1-year BHAR						
Key Indicator:		1[Green industries]	1[Polluting industries]	1[R&D expense >0]	1[>=2 industry sectors]	1[>=12 operating cities]
	(1)	(2)	(3)	(4)	(5)	(6)
PM2.5	-0.033	-0.031	-0.028	-0.031	0.022	-0.036
	(0.046)	(0.046)	(0.057)	(0.050)	(0.071)	(0.045)
Key Indicator		-0.029	-0.071	0.325	0.282	0.282***
		(0.373)	(0.114)	(0.329)	(0.204)	(0.098)
PM2.5 * Key Indicator		-0.057	-0.062	-0.059	-0.189	0.007
		(0.215)	(0.141)	(0.226)	(0.145)	(0.092)
Observations	1,071	1,071	1,071	1,071	1,071	1,071
Adjusted R^2	0.206	0.204	0.205	0.206	0.208	0.211
Panel B. Dependent variable: EBITDA/Sales						
PM2.5	-0.012	-0.014	-0.010	-0.011	-0.019	-0.010
	(0.014)	(0.014)	(0.014)	(0.014)	(0.018)	(0.015)
Key Indicator		-0.027	0.021	0.025	-0.017	0.077**
		(0.090)	(0.017)	(0.076)	(0.039)	(0.033)
PM2.5 * Key Indicator		0.044	-0.020	-0.030	0.024	-0.011
		(0.075)	(0.020)	(0.067)	(0.044)	(0.036)
Observations	1,203	1,203	1,203	1,203	1,203	1,203
Adjusted R^2	0.569	0.568	0.568	0.568	0.568	0.571

Table 10: Firms Characteristics in Multiple Reviews

This table compares characteristics of firms that was reviewed for multiple times. The first column shows characteristics before the firm being rejected in the first round of review, and the second column shows those before passing the subsequent review. The number of observations are 62 and 58, respectively. The definitions of variable are listed in Table 1.

	Rejected in the 1st review	*Passing the subsequent review*	*Diff*	*p-value*
Panel A. Firm characteristics				
Assets (in Billion RMB)	1.980	1.922	0.059	0.900
Sales (in Billion RMB)	1.270	1.236	0.033	0.915
Profitability	0.149	0.154	-0.005	0.774
Leverage	0.426	0.424	0.003	0.931
Intangibles	0.054	0.056	-0.002	0.853
CurrentRatio	2.005	2.042	-0.037	0.891
Panel B. Member characteristics				
1[Female]	0.325	0.275	0.049	0.247
1[Fulltime]	0.907	0.921	-0.014	0.624
1[Bachelor]	0.795	0.645	0.151	0.160
Experience	1.222	1.191	0.031	0.627
Age	43.228	44.187	-0.959	0.266

Table 11: Heterogeneous Effects by Firm Political Connection

This table presents heterogeneous effects by firm political connection. 1[Non-Connection] is defined as whether the firm's CEO was NOT currently or formerly an officer of either the central government of China, or a provincial government. 1[Non-(Current) Central Connection] is defined as whether the firm's CEO was NOT (currently) an officer of the central government. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year, reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]			
Key indicator	1[Non-Connection]	1[Non-Central Connection]	1[Non-Current Central Connection]
	(1)	(2)	(3)
PM2.5	0.022**	0.001	-0.008
	(0.011)	(0.016)	(0.015)
Key indicator	-0.213***	-0.159***	-0.171***
	(0.046)	(0.039)	(0.038)
PM2.5 * Key Indicator	0.054**	0.064***	0.065***
	(0.020)	(0.021)	(0.019)
Observations	1,488	1,488	1,488
Adjusted R^2	0.402	0.374	0.371

Internet Appendix

"Polluted IPOs"

CONTENT:

Internet Appendix A: Applying LDA to analyzing review questions

In order to enable the topic model to convey as much information as possible, we pre-processed the text before using the latent Dirichlet allocation (LDA) algorithm following several steps: 1. Remove the samples recorded as "no questions," and samples with question length in the 1% and 99% percentiles; 2. Remove all numbers and punctuation marks in the text; 3. Apply word segmentation package (*jieba*) to separate Chinese words. Unlike Latin languages, Chinese has no spaces between words, hence requiring word dictionary and segmentation to process the text. We add some additional financial terms[17] to the defined dictionary. 4. Remove the stop words in the text with the Chinese stop words table, which sorted out a total of 740 frequently used functional words, mainly including adverbs (e.g., some, especially, why) and conjunctions (e.g., although, otherwise, but). 5. We also remove other functional words commonly used in the context of the review question, such as millions, description, above, etc., and remove all company names. 6. Keep only the words with the frequency of the top 2,000 (out of 14,509) for analysis.

These processes remove invalid information in the inquiry process, and improves the efficiency of the LDA algorithm, enabling it to summarize key question topics. Referring to the literature on text analysis algorithms, we determined the number of topics estimated by the model according to the Perplexity score. The lower the parameter, the higher the model's generalization ability and the better fitting degree of text. As can be seen from the figure, when the number of topics increases from 7 to 8, the score decreases sharply, so the number of topics is set to 8. The results of the LDA topic model include the probability distribution of all words in in all topics, as well as all topics in all questions. We define the topic of the question as the topic with the highest

[17]The terms added include: information disclosure, controlling shareholder, independence, internal control, administrative penalty, business model, material change, shareholding structure, managerial board, core technology, investment project, raised funds, industrial policy, account receivables, and reporting period. In the default segmentation of *jieba* package, the length of the words is usually 2–3 characters in Chinese, so unless the above words are added separately, they will be processed into more than two words. For example, "information disclosure" is treated as "information" and "disclosure," which makes it difficult to express the meaning of the words themselves.

probability. Appendix Table 1 lists the top 20 keywords with the frequency of occurrence under the corresponding topic.

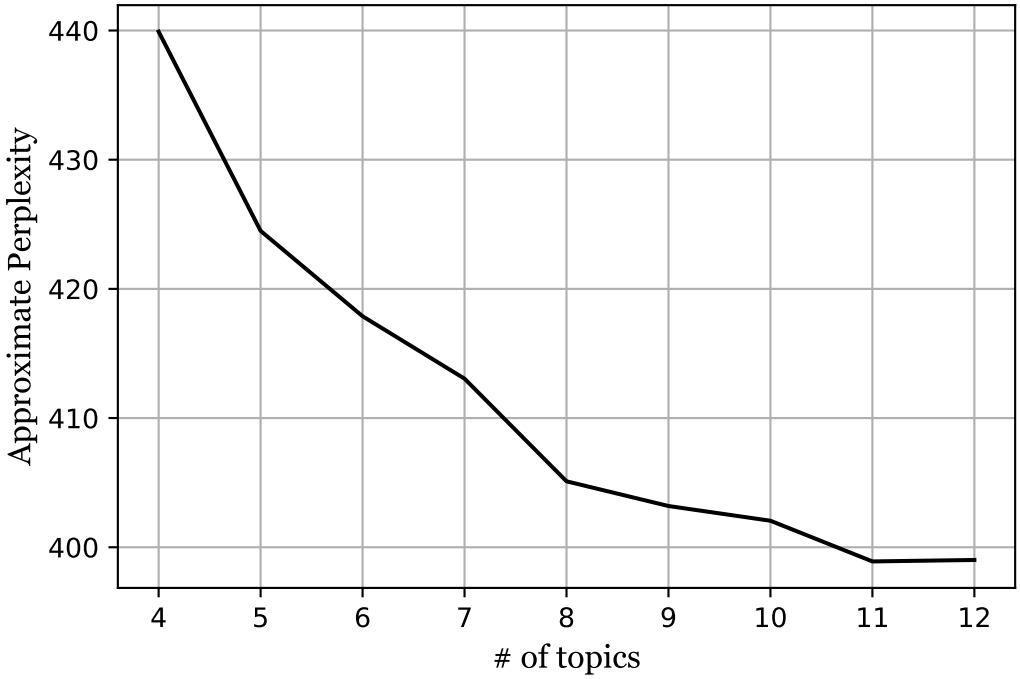
Internet Appendix Table 1: Type, Topics and Key Words of Review Questions

This table lists inquiry question topics generated by the LDA model. The model sorts questions into 8 topics and lists the frequency of words within each topic. We show the top 20 keywords here.

Type	Label	Keywords
Complex questions	Operating risk	Relevant, verification, production, existence, condition, representation, operation, opinion, impact, risk, material, system, validity, process, environmental protection, regulation, implementation, acquisition, use, compliance
	Profitability	Gross margin, reasons, reasonableness, verification, product, peer, comparable, representative, opinion, difference, above, principal, situation, decline, process, revenue, combination, clarity, variation, cost
	Shareholder	Verification, existence, shareholder, equity, actual controller, representative, opinion, transfer, relevant, cause, share, process, situation, investment, employee, holding, rationality, holding, clarity, enterprise
	Related transactions	Association, existence, transaction, related party, capital, fair, situation, verification, pricing, procurement, group, interest, reasonableness, cause, correlation, representation, opinion, relationship, loan, shareholder
Intuitive questions	Accounts receivables	Condition, rerification, cause, effect, accounts receivable, operation, existence, revenue, representation, adequacy, risk, opinion, combination, continuance, provision, reasonableness, preparation, rerformance, inventory, material
	Main business	Sales, customer, existence, distributor, check, condition, principal, cause, mode, rationality, purchase, supplier, representative, revenue, process, opinion, distribution, relationship, product, overseas
	Accounting standards	Verification, recognition, relevance, revenue, representation, situation, compliance, contract, project, opinion, regulation, enterprise, accounting standards, amount, accounting, existence, cause, treatment, process, performance
	Supplier and Customer	Business, presence, verification, major, customer, technology, representative, related, service, competition, opinion, situation, product, enterprise, risk, cooperation, R&D, industry, combination, supplier

Internet Appendix Figure 1: Perplexity score for different number of topics

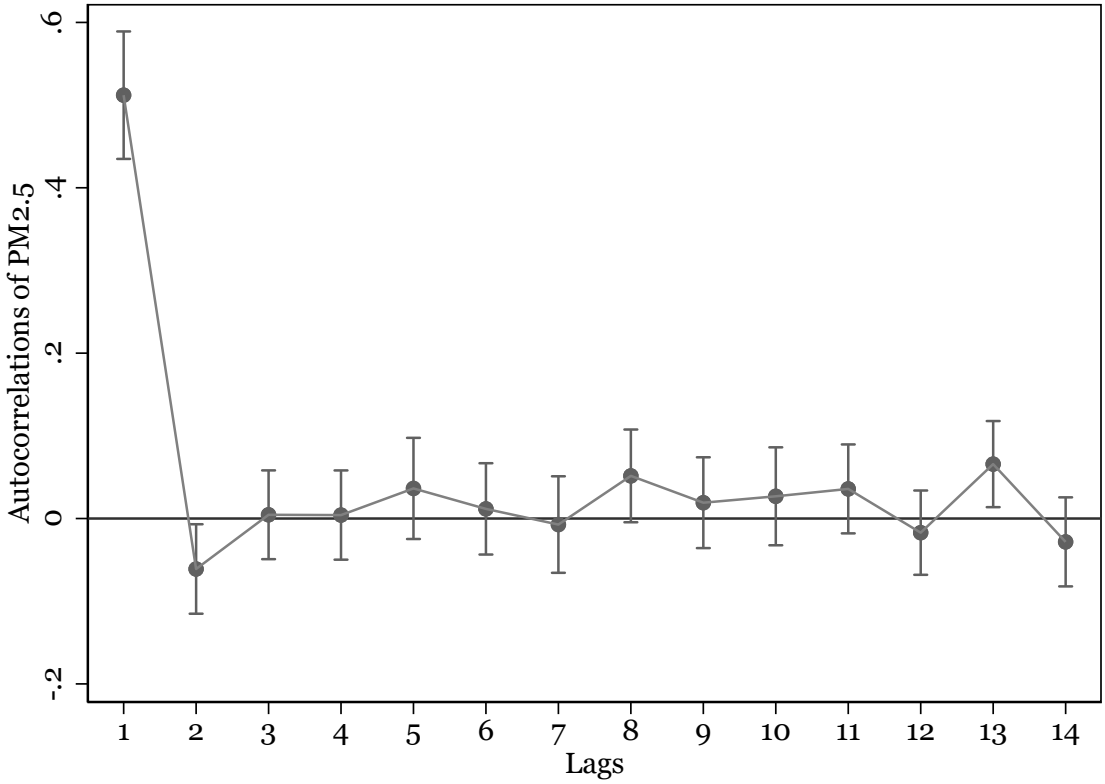
This figure shows the perplexity score for categorizing IPO review questions into various number of topics ranging from 4 to 12.



Internet Appendix B: Inter-day air pollution correlation

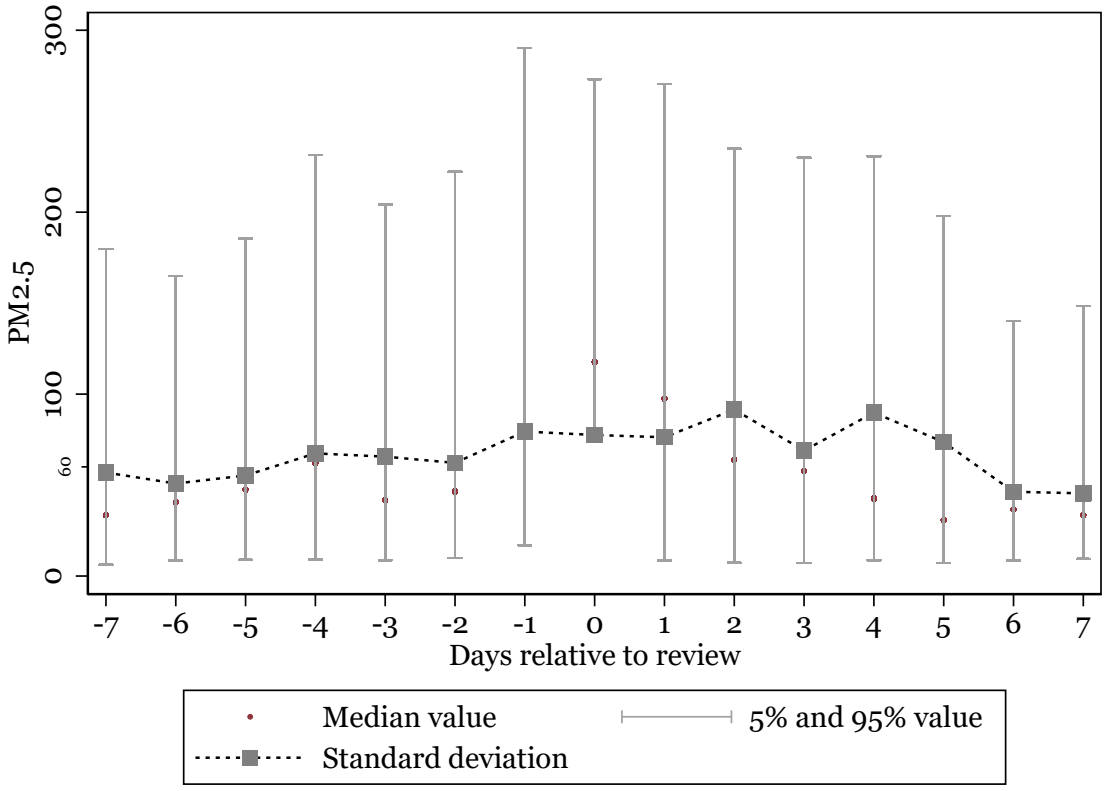
Internet Appendix Figure 2: Autocorrelation of PM2.5 at Xizhimen Monitoring Station

This figure shows the autocorrelation of average daily level of PM2.5 during working hours at Xizhimen monitoring station. The whiskers show the 95% confidence interval.



Internet Appendix Figure 3: Variation of PM2.5 before and after the review day

This figure shows the variation of average daily level of PM2.5 within a 15-day window, when the level of PM2.5 on review day is higher than 75 $\mu g/m^3$.



Internet Appendix C: Additional IPO review information

Internet Appendix Table 2: Composition of Committee Members

This table shows the composition of the review committee in our sample. Regulatory institutions include CSRC and its agencies, stock exchanges, and national ministries; market institutions include law firms, accounting firms, securities companies, fund companies, and insurance asset management companies; other institutions include universities and research institutions.

	Employment period	# of members	Regulatory institutions	Market institutions	Other institutions
16th	2014/5/23–2017/9/28	60	24	36	10
17th	2017/9/28–2019/1/29	63	39	16	8
18th	2019/1/29–present	21	13	8	0

Internet Appendix Table 3: IPO Review Outcomes

This table shows the summary of review outcomes by year. "Suspension of voting" means a decision will be made in a month. Firms with "cancellation of the review" and "non-approval" need to resubmit their application materials with substantial revision in six months.

Year	N	Approval	Non-approval	Suspension of voting
2014	103	94.17%	4.85%	0.97%
2015	226	92.92%	4.87%	2.21%
2016	253	93.28%	5.14%	1.58%
2017	436	80.50%	14.91%	4.59%
2018	153	69.93%	25.49%	4.58%
2019	125	63.20%	36.00%	0.80%
2020	192	97.40%	0.52%	2.08%
All	1488	85.15%	12.03%	2.82%

Internet Appendix Table 4: Member Replacements: Reasons and Time Distribution

This table show the number of cases when some committee member may be replaced a few days before the QA session, and the time distribution. There are a total of 30 member replacements in our sample.

Year of meeting	Reasons			Number of days before review		
	Conflict of interest	Sick leave	Other reasons	1	2	3
2014	3	0	2	1	3	1
2015	5	1	0	0	1	5
2016	0	0	1	0	1	0
2017	2	0	5	1	5	1
2018	4	0	2	5	0	1
2019	0	1	0	1	0	0
2020	1	0	3	2	0	2
Total	15	2	13	10	10	10

Internet Appendix D: Additional empirical analyses

Internet Appendix Table 5: Balance Test

This table shows the balance test of the sample mean and p-value of the mean difference at the firm level, and shows both firm characteristics in Panel A and member characteristics in Panel B. Low pollution is defined as 1 if PM2.5 is below both the median for that year and that for sample average. The number of observations for characteristics of firms reviewed on Low and High pollution days are 807 and 681, respectively. The definitions of variable are listed in Table 1.

	Low Pollution	*High Pollution*	*Diff (Low-High)*	*p-value*
Panel A. Firm characteristics				
Assets (in Billion RMB)	13.355	20.222	-6.866	0.610
Sales (in Billion RMB)	1.372	1.937	-0.565	0.274
Profitability	0.158	0.150	0.008	0.188
Leverage	0.423	0.405	0.017	0.109
Intangibles	0.049	0.049	0.000	0.854
CurrentRatio	2.394	2.243	0.152	0.210
1[SOE]	0.071	0.091	-0.020	0.148
1[Foreign]	0.032	0.037	-0.004	0.635
1[Polluting industries]	0.185	0.166	0.019	0.346
1[Green industries]	0.068	0.079	-0.011	0.412
Panel B. Member characteristics				
1[Female]	0.262	0.249	0.013	0.356
1[Fulltime]	0.878	0.867	0.011	0.315
1[Bachelor]	0.687	0.685	0.001	0.964
Experience	1.299	1.343	-0.044	0.054*
Age	44.155	44.232	-0.078	0.720

Internet Appendix Table 6: Robustness on Factors Affecting IPO Review

This table shows the robustness tests considering IPO-related policies and other factors that may affect the pass rate. Column (1) includes the committee employment period fixed effects. Column (2) only includes observations from the main board. Column (3) excludes sample after June, 2019 when the pilot registration system was introduced for the STAR market. Columns (4)–(6) exclude samples during the policy stimulus period, the era with tight pollution control, and during the COVID-19 pandemic period. Column (7) include individual member fixed effects. Column (8) includes month fixed effects. Column (9) controls for level of PM2.5 of the city where firm is registered on the review day, and column (10) includes city fixed effects. Column (11)–(12) controls for political connections of the financial intermediaries defined as Chen et al. (2017), and of the firm defined as Fan et al. (2007), respectively. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, and chairman fixed effects. Standard errors are clustered by industry-year, and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]						
	Term period FE	Main board sample	Excluding period after STAR exchange	Excluding stimulus period	Excluding pollution control period	Excluding Covid period
	(1)	(2)	(3)	(4)	(5)	(6)
PM2.5	0.046***	0.052***	0.047***	0.061***	0.059**	0.047***
	(0.009)	(0.016)	(0.010)	(0.016)	(0.025)	(0.009)
Observations	1,488	701	1,226	905	464	1,296
Adjusted R^2	0.355	0.360	0.360	0.392	0.547	0.355
	Individual member FE	Month FE	Controling for firm city PM2.5	Firm city FE	Controling for inter-mediary connection	Controling for firm connection
	(7)	(8)	(9)	(10)	(11)	(12)
PM2.5	0.040***	0.043***	0.042***	0.050***	0.046***	0.041***
	(0.010)	(0.009)	(0.010)	(0.011)	(0.009)	(0.010)
Observations	1,488	1,487	1,046	1,110	1,488	1,488
Adjusted R^2	0.361	0.358	0.340	0.330	0.356	0.400

Internet Appendix Table 7: Falsification Tests

This table shows the effect of PM2.5 at different locations and time periods. Column (1) includes PM2.5 during different periods at the baseline station. Column (2) includes PM2.5 in Tianjin, a city close to Beijing. Column (3) includes PM2.5 on the day when the review committee is assigned, about a week before the review day, and column (4) includes PM2.5 30 days before review. The variable definitions are listed in Table 1. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, day of week, and chairman fixed effects. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]				
	Time	Other area	Announcement day	Random day
	(1)	(2)	(3)	(4)
PM2.5	0.035**	0.041***	0.041***	0.045***
	(0.014)	(0.011)	(0.011)	(0.009)
PM2.5_night	0.018			
	(0.012)			
PM2.5_dawn	-0.003			
	(0.017)			
PM2.5_Tianjin		-0.004		
		(0.013)		
PM2.5_announcementday			0.006	
			(0.011)	
PM2.5_randomday				-0.003
				(0.010)
Observations	1,488	1,387	1,488	1,488
Adjusted R^2	0.356	0.304	0.356	0.356

Internet Appendix Table 8: Online Review

This table shows the result of reviews during online review period. Both column control for PM2.5 at firm city, and column (2) interacts the dummy indicator Online review with PM2.5 levels. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, and chairman fixed effects. Standard errors are clustered by industry-year, and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: 1[Passing review]		
	(1)	(2)
PM2.5	0.050***	0.053***
	(0.011)	(0.011)
PM2.5_Firm	0.000	-0.003
	(0.026)	(0.027)
Online review		0.014
		(0.034)
PM2.5 * Online review		-0.083
		(0.087)
PM2.5_Firm * Online review		0.116
		(0.117)
Observations	1,110	1,110
Adjusted R^2	0.330	0.329

Internet Appendix Table 9: Review Questions and Pass Rate

This table shows how inquiry questions raised during the meeting affects the pass rate. Columns (1)–(4) discuss the impact on the number and length of questions, and (5)–(6) show the complexity. The variable definitions are listed in Table 1. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, and chairman fixed effects. Standard errors are clustered by industry-year and reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable: 1[Passing review]					
Key variable:	Total Number of questions	Length of questions	Number of 'big' questions	Number of Follow-up questions	1[Complex > Intuitive questions]	Complex questions (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Key variable	-0.007***	-0.000***	-0.015**	-0.018**	0.002	-0.030*
	(0.002)	(0.000)	(0.007)	(0.008)	(0.010)	(0.016)
Observations	1,173	1,173	1,173	1,172	1,172	1,172
Adjusted R^2	0.125	0.135	0.107	0.112	0.102	0.103

Internet Appendix Table 10: Post-IPO Performance

This table presents the post-IPO performance of the firms reviewed on polluted days. The dependent variables of columns (1)–(4) are the average EBITDA to sales ratio, net profit margin, ROA, and EPS in 3 years after IPO. The variable definitions are listed in Table 1. All regressions include control variables as in column (2) of Table 3, as well as industry, province, quarter, and chairman fixed effects. Standard errors are clustered by industry-year, reported below the regression coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	EBITDA ratio	Profit Margin	ROA	EPS
	(1)	(2)	(3)	(4)
PM2.5	-0.012	0.031	-0.102	-0.024
	(0.014)	(0.300)	(0.171)	(0.018)
Observations	1,203	1,203	1,203	1,196
Adjusted R^2	0.380	0.380	0.380	0.380