Environmentally Inclined Politicians and Local Environmental Performance: Evidence from Publicly Listed Firms in China[*]

Hanming Fang[†], Honglin Ren[‡], Danwen Song[§], Nianhang Xu[**]

Abstract

We investigate whether environmentally inclined politicians (EIPs), that is, politicians with environment-related work experience, affect local environmental performance in China. We find that firms located in cities with EIPs have lower levels of sulfur dioxide emissions. The effect is attenuated when politicians are in their second term and for economically important firms. Furthermore, firms in cities with EIPs increase abatement efforts, commit fewer environmental violations, receive more green subsidies, and establish polluting subsidiaries in other cities. In addition, the promotion likelihood of EIPs is also negatively related to local emissions levels. The findings suggest that EIPs strategically leverage their expertise to focus more on environmental causes.

JEL classification: D72, G38, Q53
Keywords: Environmental performance, environmentally inclined politicians, political promotion

---

[*] We thank Zhe Li, Huihua Nie, Kuo Zhang, Daxuan Zhao, and seminar and conference participants at Renmin University of China, Xiamen University, Southwest University, Liaoning University, Huazhong University of Science & Technology, and the China Financial Research Conference for helpful comments and suggestions. Nianhang Xu acknowledges the financial support from the National Natural Science Foundation of China (Grant no. 72225005 and 72150004). Honglin Ren acknowledges the financial support from the National Natural Science Foundation of China (Grant no. 72202225). We thank the organizers of the 2023 China Financial Research Conference for the Corporate Finance Best Paper Award. All remaining errors are our own.

[†] Fang: Department of Economics, University of Pennsylvania, 133. S. 36th St., Philadelphia, PA, United States, 19104 (email: hanming.fang@econ.upenn.edu).

[‡] Ren: Department of Finance, School of Business, Renmin University of China, Beijing, PR. China, 100872 (email: renhonglin@rmbs.ruc.edu.cn).

[§] Song: Department of Finance, School of Business, Renmin University of China, Beijing, PR. China, 100872 (email: dwsong@ruc.edu.cn).

[**] Xu: Department of Finance, School of Business, Renmin University of China, Beijing, PR. China, 100872 (email: nhxu@ruc.edu.cn).

1. Introduction

Environmental, social, and governance (ESG) refers to three key factors that measure the sustainability and ethical impacts of a firm. Globally, investors are increasingly demanding investment opportunities that incorporate ESG considerations.[1] In light of global attention to environmental issues, a large body of literature has emerged to investigate what affects firms' environmental performance. Characteristics shown to be associated with a firm's environmental outcomes include the markets in which the firm operates, the firm's leadership, its ownership structure, and financial performance (Gillan, Koch, and Starks, 2021). In Western countries where market forces hold significant sway, institutional investors and social pressure from environmental activists have played an increasing role in promoting environmental protection (Kim et al., 2019; Chu and Zhao, 2019; Azar et al., 2021). By contrast, in China, where the government continues to play an important role in its economic and social development, environmental protection often rests in government enforcement of its regulations and the implementation of top-level policy guidance. Much of the implementation and enforcement falls on local government officials (Chen, Li, and Lu, 2018; Karplus, Zhang, and Zhao, 2021).

The purpose of this paper is to examine the relation between local environmental performance and city leaders' past environment-related work experience. We refer to politicians with prior environment-related work experience as *environmentally inclined politicians* (EIPs). Prior literature suggests that past experience of decision makers affects their future economic decisions (Bamber, Jiang, and Wang, 2010; Bradley, Gokkaya, and Liu, 2017; Malmendier and Wachter, 2022). Yet, little is known about how city leaders' experience affects local environmental

[1] https://www.morningstar.com/articles/961765/sustainable-fund-flows-in-2019-smash-previous-records. https://www.msci.com/research-and-insights/2022-esg-trends-to-watch

performance. We argue that city leaders' past environment-related work experience plays a role in local environmental performance, through two possible mechanisms. On the one hand, EIPs have more experience in the local government agencies in charge of environmental and ecological issues and have more expertise in pollution control and improving the local environment; thus, their marginal cost of effort in reaching environmental goals is lower than that of non-EIPs. In a multi-tasking model in which protecting the environment and developing the economy can both contribute to promotions, EIPs who have a comparative advantage in environmental protection will choose to optimally allocate more effort to environmental causes than their non-EIP counterparts. On the other hand, EIPs may have a stronger preference toward environmental protection, even if better environmental performance does not translate into an increase in their promotion chances. We refer to the first mechanism as the *strategic* channel and the second as the *preference* channel. Both channels predict a positive (negative) relation between EIPs and local environmental performance (emissions).

We conduct our empirical analysis on publicly listed firms in China and supplement with city-level evidence for the following reasons. First, in China, environmental issues are mainly guided by central government policies but addressed and enforced at the local government level. Therefore, China represents an ideal setting to study the role of local government officials in pollution control. Second, publicly listed firms are economically important and account for a significant proportion of the industrial pollutions in China.[2] Third, public firms are subject to reporting requirements, so we can observe the details about the subsidies they receive from the

[2] The total market value of publicly listed firms is 96.53 trillion yuan, which is about 84.4% of China's GDP. In 2021, the total revenue of listed companies was 64.97 trillion yuan. The R&D investment of non-financial listed companies totaled 1.31 trillion yuan, accounting for 47.02% of the national enterprise R&D investment. Furthermore, the CDP Carbon Majors Report (2017) shows that the cumulative emissions of 15 Chinese public firms in the coal industry accounted for 14.3% of global emissions for period between 1988 and 2015.

government, as well as environmental sanctions, which aid our understanding of how local government officials implement environmental regulations and policy guidance. Fourth, the disclosure requirements for publicly listed firms enable us to explore corporate strategies in response to increased local environmental enforcement, including establishing polluting subsidiaries in other cities. Finally, we also investigate the relation between EIPs and city-level environmental and economic performance and link them to EIPs' career advancement probabilities to better understand the career incentives faced by city leaders.

We measure firms' environmental performance using sulfur dioxide (SO_2) emissions because that is the main type of air pollutant emitted by firms and was a key environmental target during our sample period (Chen, Li, and Lu, 2018; Liu et al., 2021). Our data on SO_2 emissions, which we obtain from the Environmental Survey and Reporting (ESR) database, are at the subsidiary level. We aggregate subsidiary-level emissions data to the firm level using the list of subsidiaries disclosed in the company information file from the Chinese Research Data Services Platform (CNRDS). We start by examining the relation between EIPs and the emission intensity of local publicly listed firms in their jurisdictions. A city is considered to have an EIP if either its mayor or Chinese Communist Party (CCP) Secretary is an EIP. In a regression analysis controlling for firm, city, politician characteristics, and firm, city, and year fixed effects, we find that firms headquartered in cities with EIP leaders have 46.9% less SO_2 emissions per unit of operating income. Further analysis suggests that the effect is largely driven by firms' investments in expanding emission abatement capacity.

To address the potential endogeneity issues, for example, the appointment of EIPs is correlated with previous city-level or firm-level emissions, or that differences in firm-level emissions ex post are sourced from their differences ex ante, we conduct a matched sample analysis using a propensity score matching method. We focus on the switch sample in which a firm experience a turnover of the city leader from a non-EIP to an EIP, and we match on city characteristics including GDP, population, wage, and the value-added of the secondary industry as a percentage of GDP, as well as firm characteristics including SO_2 emission levels, firm size, leverage level, ROA, and firm age. In the final sample we have 99 switch events at the firm level. In this matched sample analysis, we further find a negative and statistically significant relation between EIPs and local firms' SO_2 emission levels. We also conduct a determinants analysis of EIPs at the city level. We observe no significant relation between city characteristics and the appointment of an EIP to a city, suggesting that there is not a very strong selection issue in appointing an EIP to a city with particular characteristics.

To shed light on whether the strategic or the preference motivation drives our results, we perform a series of cross-sectional analyses in which politicians face varying degrees of career motivations. First, we test whether the effect is stronger or weaker when the politician is less motivated to advance his/her career because he/she is already in his/her second term. Therefore, if we still observe any effect of EIPs on environmental performance improvement, the effect is more likely to be driven by the preference channel rather than the strategic channel. Conversely, a weaker effect for EIPs in their second term would be more consistent with the strategic channel. Second, we explore whether the economic importance of a firm affects the relation between EIPs and firm emissions. If the result is driven by the preference channel, we would not expect the economic importance of a firm to mediate the relation. However, if the result is driven more by the strategic channel, we would expect the effect to be weaker for firms that are more important to the local economy. We find that the effect of EIPs on environmental performance is much weaker when the politician is in his/her second term and when the firm is more economically important. These findings are consistent with the strategic rather than the preference motivation for EIPs.

Next, we explore the ways through which EIPs regulate local firms' emissions or incentivize firms to achieve environmental goals. First, we find that firms located in cities with EIPs experience a greater likelihood of having environmental violations detected, and hence they have an ex ante lower tendency to violate environment regulations. Second, we document that firms located in cities with EIPs receive more green subsidies from the local government for green innovations or projects. The evidence collectively supports the hypothesis that EIPs put more effort into environmental matters, providing both "carrots" and "sticks" to incentivize firms to "go green."

Several studies document firms' strategic responses to increasingly stringent environmental policies, including shifting production to non-regulated firms under the same conglomerates (Chen et al., 2021) or moving out of states with stricter policies (Bartram, Hou, and Kim, 2022). Furthermore, Akey and Appel (2021) show that changes in parent limited liability protection affects subsidiaries' environmental performance. Motivated by these studies, we explore potential externalities generated by EIPs across firms' subsidiaries. We document two different effects. First, we find that when the parent company's headquarters city is led by an EIP, the emission level of its subsidiaries located outside of the headquarters city is also reduced, suggesting a positive spillover effect on emission controls of non-local subsidiaries. However, when examining the firm's decision to establish new polluting subsidiaries, we find that the firm is more likely to establish a subsidiary in non-local cities without EIPs.

To further gauge whether EIPs improve environmental performance from a strategic or a preference motivation, we examine the relation between EIPs and local economic performance and other factors that determine their career advancement probability. Regional economic performance has long been suggested to be a key driver for the career advancement of local leaders (Li and Zhou, 2005; Wang, Zhang and Zhou, 2020). Local environmental performance has been included in the local officials' performance evaluation system only since China's Eleventh Five-Year Plan (2006–2010). The emphasis on the environment was further strengthened after President Xi Jinping took office in 2013. From the strategic point of view, an EIP would not improve the local environment at the cost of economic performance. However, if an EIP truly desires a better environment and injects this preference into work, local economic development might be sacrificed for better environmental performance. Therefore, we examine the relation between EIPs and local economic performance. Using either the growth rate of local GDP or local GDP per capita as the measure of economic performance, we do not find a difference in the economic performance of EIPs and non-EIPs. Furthermore, we examine the factors affecting politicians' career advancement likelihood. We find that EIPs' career advancement likelihood is negatively related with local SO_2 emission levels, suggesting that EIPs' evaluations put greater weight on local environmental performance. This link between career advancement and environmental performance further rationalizes EIPs' strategic incentives to perform well in the environmental protection area.

Our study contributes to the literature examining the relation between internal and external governance structure and firms' environmental performance. Past studies document various factors that are associated with a firm's environmental performance including CEO characteristics (Lewis, Walls, and Dowell, 2014), ownership structure (Kim et al., 2019; Hong, Karolyi, and Scheinkmanm2020; Shive and Forster, 2020; Azar et al., 2021; Dasgupta, Huynh, and Xia, 2023), financial performance (Liu et al., 2021), pressure from supply chains (Dai, Liang, and Ng, 2021; Shi, Wu, and Zhang, 2022), and country emission taxes (Lin, 2013; Brown, Martinsson, and

Thomann, 2022). We provide a new perspective for understanding the role of government, especially government officials, in local public firms' environmental performance. Moreover, the presence of an EIP in a firm's headquarters city affects the environmental performance of firm subsidiaries located in other cities and affects the firm's decisions about where to establish new polluting subsidiaries. These findings further complement studies documenting conglomerate firms' regulatory arbitrage strategies when faced with increasingly stringent environmental policies (Chen et al., 2021; Bartram, Hou, and Kim, 2022) and how changes in a parent company's limited liability affect subsidiary environmental performance (Akey and Appel, 2021).

The study also contributes to our understanding of the effects of politicians' backgrounds on their political preferences and behavior in office. Past studies show that politicians with business experience make different municipal fiscal policies (Kirkland, 2021) and prioritize economic over social infrastructure (Szakonyi, 2021), that Republican state governors in the United States implement environmental protection policies that are more conservative (Raff, Meyer, and Walter, 2022), and that lawmakers who received more contributions from carbon-intensive firms are more likely to cast anti-climate votes (Gao and Huang, 2022). We add to the literature by showing that politicians with past environment-related work experience have better local environmental performance. Their behavior is more consistent with strategically leveraging their expertise in environment protection to gain potential advantages in career advancement rather than a pure preference for a better environment.

Our study also contributes to the incentive scheme faced by politicians. The literature documents mixed results on the importance of economic performance (Li and Zhou, 2005; Yao and Zhang, 2013; Chen and Kung, 2016) and environmental performance (Wu and Cao, 2021) in government officials' career advancement. In our study, we consider heterogeneities in politicians and the potentially different incentive schemes faced by politicians with different characteristics or backgrounds. Specifically, we show that environmental performance is particularly important for the career advancement of EIPs, indicating that politicians' characteristics and expertise are factored into their performance evaluation. In turn, EIPs respond to the incentive scheme by tilting their efforts toward different aspects of their work.

2. Institutional Background and Hypothesis Development

2.1 Background on environmental policy

Karplus, Zhang, and Zhao (2021) provide a detailed review on the history of China's environmental policy and regulatory system. In this section, we provide a summary of China's environmental policy, focusing on the sample period in this study (2003–2020).

In China, government planning continues to play an important role in both economic growth and environmental protection. China's Five-Year Plans (FYPs) define the overarching principles to guide national policies and priorities for the subsequent five years. Through FYPs, the central government sets environmental priorities and targets, as well as the enforcement and assessment mechanisms. To limit environmental damage, the Tenth FYP (2001–2005) set caps on national emissions of six pollutants with specific caps for each province. However, these caps were not met due to lax enforcement (Kahn, Li, and Zhao, 2015). The Eleventh FYP (2006–2010) mandated, for the first time, that local governors would be evaluated on whether their jurisdiction met the emission targets for some pollutants, such as SO_2 (Jin, Andersson, and Zhang, 2016; Chen, Li, and Lu, 2018; Stoerk, 2018; Karplus, Zhang, and Zhao, 2021; Liu et al. 2021). In the 2010s, environmental protection became an important political objective of the ruling CCP, which referred to environmental protection as the "ecological civilization." The Twelfth FYP (2011–

2015) continued to strengthen the binding targets for environmental protection, including plant-level standards for water and air pollutant emissions, and set ambient water and urban air quality targets. At the end of 2013, the Organizational Department of the CCP Central Committee issued a notice on CCP leaders' and government officials' evaluations that further emphasized "sustainability, social progress, [and] ecological civilization," and increased the weight given to environmental protection in the cadre evaluation system.[3]

In March 2014, Premier Li Keqiang "declared war" on pollution at the opening of the China's National People's Congress.[4] CCP General Secretary Xi Jinping also emphasized that only with the strictest systems and the rule of law could the state provide reliable guarantees for the building of an ecological civilization. The slogan of "Gold mines override clear water and green mountains" evolved into "Clear water and green mountains are gold mountains and silver mountains" today. The government undertook unprecedented regulatory changes on multiple fronts (Greenstone et al., 2021; Karplus, Zhang, and Almond, 2018; Karplus, Zhang, and Zhao, 2021). In 2015, the new Environmental Protection Law (EPL) also took effect.[5] The EPL is perceived as the strictest law in the history of environmental protection in China. The revised EPL was designed to address poor enforcement, which is the root cause of China's environmental regulation failures, by introducing new penalties on firms for environmental violations, including suspension of production, administrative detention, and criminal charges. It also places more responsibility and accountability on local governments and law-enforcement agencies (Zhang et al., 2016).

---

[3] http://dangjian.people.com.cn/GB/136058/427510/428084/428612/428615/index.html (in Chinese)
[4] https://www.reuters.com/article/us-china-parliament-pollution-idUSBREA2405W20140305
[5] The EPL was issued on a trial basis in 1979 and became a permanent law in 1989.

2.2 Hypothesis

Plenty of evidence suggests that an individual's prior professional experience plays an important role in shaping his/her views and preferences on certain issues and subsequently affects his/her work performance. For example, Bamber, Jiang, and Wang (2010) show that managers promoted from finance, accounting, and legal career tracks are more likely to develop corporate disclosure styles displaying certain conservative characteristics. Custódio and Metzger (2014) show that CEOs with financial work backgrounds tend to hold less cash, more debt, and engage more in share repurchases. Bradley, Gokkaya, and Liu (2017) find that analysts' prior industry experience helps improve their forecasting accuracy. Kirkland (2021) shows that mayors with prior business experience are more likely to invest in infrastructure while curtailing redistributive spending. Relatedly, Szakonyi (2021) shows that Russian businesspersons who become politicians prioritize economic over social infrastructure. Under this framework, relative to local leaders without any relevant work experience in local environmental and ecological bureaus, EIPs are more likely to emphasize environmental issues and pollution control and have different environmental performance outcomes.

There are several channels through which EIPs may have different environmental outcomes than non-EIPs. First, EIPs have more expertise and experience in local environmental protection; thus, their marginal cost of effort in reaching environmental goals could be lower than that of non-EIPs. In a multitasking agency problem for government agents, career concern theories suggest that top bureaucrats are largely driven by the outcomes of their mandated tasks (Holmstrom and Milgrom, 1991; Dewatripont, Jewitt, and Tirole, 1999; Chen, Li, and Lu, 2018). When both environmental performance and economic performance can contribute to the promotion, EIPs will choose to optimally allocate more effort to environmental causes than non-EIPs because they have a comparative advantage in environment protection.

Second, EIPs may have a stronger preference toward environmental protection, even if better environmental performance does not increase their promotion chances. The literature provides evidence for the view that economic agents inject their personal preferences into their professional life. Most relatedly, Cordano and Frieze (2000) show that pollution reduction preferences of managers directly influence the environmental performance of their manufacturing organizations. Zhi (2021) shows that nature-loving CEOs are more likely to participate in environmental protection projects. Raff, Meyer, and Walter (2022) show that in the United States, states governed by Republicans require cheaper and less effective abatement technologies than states governed by Democrats. Similarly, when we consider related work experience as one possible source of politicians' preferences, EIPs might be more proactive in addressing environmental issues compared to non-EIPs.

We refer to the first mechanism as *strategic* channel and the second as the *preference* channel. Both channels predict a negative relation between EIPs and SO_2 emission levels.

H1: Firms located in cities with EIPs have lower SO_2 emission levels.

To tease out which channel is more prevalent, we identify scenarios in which the strategic motivation is weaker or stronger to examine whether the effect of EIPs on environmental performance is similarly weakened or enhanced. First, when politicians are in their second term, their chance of promotion is significantly lower, and thus the strategic motivation for improving environmental performance is weaker (Li and Zhou, 2005). Therefore, in this sample, we would expect a weaker relation between EIPs and environmental performance if the strategic channel dominates. Second, when a firm contributes significantly to the local economy, it weakens the incentive for politicians to regulate its environmental performance if their motives are more strategic as opposed to their having a preference for a better environment. Therefore, in this sample, we would also expect a weaker relation between EIPs and environmental performance.

H2a: If the strategic channel is more dominant, the relation between EIPs and environmental performance is weaker when the politician is in his/her second term and for economically important firms.

H2b: If the preference channel is more dominant, the relation between EIPs and environmental performance would not be weaker when the politician is in his/her second term or for economically important firms.

Empirical evidence suggests a negative relation between environmental improvement and economic growth (Greenstone, 2012; Walker, 2013; Chen, Li, and Lu, 2018; Li et al., 2020) although both potentially affect politicians' career advancement. An EIP who has a lower cost of achieving environmental goals and strategically considers the tradeoffs between environmental and economic performance might not have inferior economic performance while improving environmental performance. For example, a strategic EIP might consider the economic importance of firms when regulating pollutant emissions. However, if a politician acts more out of a pure preference for a better environment to ensure long-term green and sustainable development, he/she might sacrifice economic development, which may lead to differences in economic performance between cities under the leadership of EIPs and those of non-EIPs.

H3a: The local economic performance of EIPs is not different from non-EIPs if EIPs strategically consider the tradeoffs between environmental and economic performance.

H3b: The local economic performance of EIPs is worse than non-EIPs if EIPs improve local environmental performance at the cost of local economic development arising from strong personal preference.

3. Data and Variables Construction

3.1 Data on politicians' work experience

We identify 2,078 city party secretaries and mayors who served in 337 Chinese cities from 2003 to 2020.[6] City leaders' background information and work experience data are more complete after 2003. Furthermore, city-level pollutant emissions information is available starting in 2003. Following Fang et al. (2022), we manually collect résumés of the 2,078 city leaders. These résumés contain detailed information including gender, age, educational background, hometown, and work experience prior to their current positions. For most politicians such information is publicly disclosed on official government websites. When not available on the official website, we search for the information through Baidu (www.baidu.com), China's most popular search engine, and city statistical yearbooks.

We identify a politician as an EIP as follows. First, we read through each résumé to collect information on environment-related positions and the associated start and end date. Environment-related positions include: (1) environmental authorities at all levels (e.g., the Ministry of Ecology and Environment, provincial departments/municipal bureaus of ecology and environment, environmental protection and resources conservation committees of national/local People's

[6] Fang et al. (2022, p.5) notes that "There are five levels of government hierarchy in China: the central government and the four levels of local governments: the provincial level, the city/municipality level, the county level, and the township level. According to the 2014 China City Statistical Yearbook, there are 297 cities across 31 provinces and 4 centrally administrated cities (Beijing, Shanghai, Tianjin, and Chongqing) in mainland China. The top two leaders at the city level are the city's Communist Party Secretary and the mayor, reflecting the dual presence of the Communist Party and the government at each level of China's political hierarchy (Li and Zhou, 2005). City official turnover is under the control by the Organization Department of the Provincial Party Committee."

Congresses, the Chinese People's Political Consultative Conference (CPPCC) special committees on population, resources and environment, etc.); (2) other environment-related departments and public institutions (e.g., administration of forestry and grassland/ natural resources/ energy, leading group for addressing climate change and energy conservation and emission reduction, research institute of environmental science, environmental protection department in SOEs, etc.). Second, deputy mayors are regularly assigned to take responsibility in a specific field such as finance, education, agriculture, or the environment, but résumés rarely disclose this information. Therefore, for politicians who have served as deputy mayors, we collect the detailed responsibilities of deputy mayors from local governments' work documents in PKULaw Database (https://pkulaw.com/) and related news reports from WiseSearch and CNKI.net. Through this process, we further identify the politicians who have overseen environmental protection work (e.g., cooperating with upper and lower levels of environmental authorities, inspecting polluting firms, promoting the implementation of environmental policies) as EIPs. Altogether, we identify 184 out of 2,078 (8.85%) politicians with prior environment-related work experience.

3.2 Environmental performance data

Our sample of public firms starts from all non-financial firms listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange in China from 2003 to 2014. The public firm sample starts in 2003 to be consistent with the starting year for data on local officials and ends in 2014 due to the availability of information on pollutant emissions. During this period, publicly listed firms rarely reported their polluting information at the firm level. However, emissions were disclosed by individual manufacturing establishments (Liu et al., 2021). To measure emissions at the public firm level, we identify establishments associated with each listed firm using disclosed lists of subsidiaries in company information files from the Chinese Research Data Services Platform (CNRDS). We start with a name match. For the cases in which one establishment is matched to multiple listed firms in the same year through the name matching process, we manually check the ownership status using an online database called Qichacha (https://www.qcc.com/), which contains various sources of firm/establishment–level information from the National Enterprise Credit Information Publicity System, the Judgment Document Network, the Intellectual Property Office, corporate annual reports, etc. If it is still difficult to decide on the firm-establishment mappings after the above procedures, the data on this establishment are removed.

Establishment-level emissions data and abatement information are from the Environmental Survey and Reporting (ESR) database, which is jointly administered and maintained by the Ministry of Ecology and Environment (or the former Ministry of Environmental Protection/ State Environmental Protection Administration) and the National Bureau of Statistics. The ESR is the most comprehensive environmental dataset in China and is used in various studies (He, Wang, and Zhang, 2020; Liu et al., 2021). Pollution-emitting establishments are required to report detailed environmental data on the amount of emissions of major pollutants each year. This information is cross-verified by the local environmental protection authorities, and the person who provides this information is held legally responsible for the accuracy and reliability of the provided data (Liu et al., 2021). Liu et al. (2021) and He, Wang, and Zhang (2020, p.2149) also note that "the ESR data is first self-reported by each polluter, and then randomly verified by government auditors. To ensure data quality for policy making, the Environmental Protection Law explicitly states that the ESR data cannot be used as the basis for punishing and regulating the polluting firms. As a result, the polluting firms covered in the ESR sample have little incentive to misreport their emission records."

We focus on SO_2 emissions, the main type of air pollutant emissions produced by firms and a key target of environmental regulation and enforcement during our sample period (Chen, Li and Lu, 2018; Liu et al., 2021).[7] Compared to other indicators of pollution, for example, ammonia nitrogen (NH_3N) and biological oxygen demand (BOD), SO_2 is emitted by most industrial firms and has thus become a key indicator under routine monitoring in China. Moreover, the data coverage on this measure in the ESR database is more complete than other pollutant measures. Establishment-level characteristics including age, location, and financial information are from the Annual Surveys of Industrial Firms (ASIF) conducted by the National Bureau of Statistics of China.

After we aggregate the establishment-level data to the public firm level, we require a firm to have at least three years with non-zero SO_2 emissions to be included in our analysis so that we observe a firm multiple times in the sample.[8] Our final sample includes 815 firms, of which 644 are from the manufacturing industry, and the sample covers 55.67% of all high-polluting firms according to the definitions from the Ministry of Ecology and Environment (or the former Ministry of Environmental Protection). Our final analysis sample consists of 5,721 firm-year observations. Following Liu et al. (2021), our key measure for SO_2 emissions at the firm-year level, *SO_2_Firm*, is defined as the amount of total SO_2 emissions (in tons) scaled by the firm's operating income (per 1,000,000 CNY) with adjustment for inflation.

Firms can change their emission behavior typically through either shifting toward cleaner technology or increasing pollutant abatement efforts. Information provided in the ESR database

7 SO_2 is inspected daily by multiple levels of government officials, which is in accordance with the notice issued by the State Environmental Protection Administration on the promulgation of The Eleventh Five-Year Plan (2006-2010) for the verification methods (trial) of major pollutant total reduction (http://www.gov.cn/gongbao/content/2008/content_961664.htm in Chinese).

8 We require a minimum of three years of SO_2 data for a firm to be included in our sample for two reasons: (1) to focus on the sample of firms with SO_2 as one of the main pollutant types; and (2) to avoid firms with poor disclosures on SO_2 emissions.

allows us to further explore these two possible and non-mutually exclusive sources. In addition to SO_2 emissions released into the environment, the data provide the amount of SO_2 produced and removed. The amount of SO_2 produced is the sum of SO_2 emissions and SO_2 removed. Furthermore, the database has information on abatement efforts including the number of pollutant treatment facilities (*Facility*) and waste gas treatment capacity (*Capacity*). All this information is similarly aggregated from the establishment level to the public firm level.

City-level environment performance data include industrial SO_2 emissions and several types of air pollutions including NO_2, dust, PM2.5, and industrial sewage. The SO_2 data from 2003 to 2020, dust emissions data from 2011 to 2019, and industrial sewage data from 2003 to 2020 are from China City Yearbooks. NO_2 data from 2013 to 2020 are from the CNRDS and PM2.5 data from 2003 to 2020 are from the Atmospheric Composition Analysis Group derived from satellite data (van Donkelaar et al., 2016).

Other firm-level control variables including size (*Size*), firm age (*FirmAge*), leverage (*Lev*), ROA, ratio of tangible assets (*Tangible*), industry competition (*Competition*), SOE status and the percentage of shares held by foreign shareholder (*Foreign*) are from the China Stock Market and Accounting Research (CSMAR) database. Establishment-level control variables, including output and age, are from the Annual Surveys of Industrial Firms (ASIF). Macroeconomic control variables at the city level, including GDP, the value-added of the secondary industry as a percentage of GDP, population, and average wage, are from China City Yearbook, China Urban-Rural Construction Statistical Yearbook, and the National Bureau of Statistics (NBS). Appendix A provides variable definitions.

3.3 Descriptive statistics

[Table 1 About Here]

Panel A of Table 1 presents the descriptive statistics for key variables used in our analysis. At the firm-year level, the key explanatory variable *EIP* takes on the value of one for approximately 11.6% of the observations. The mean of SO_2*_Firm* is 0.465, meaning that an average public firm in our sample releases 0.465 tons of SO_2 per million CNY of operating income. Figure 1 further plots the proportion of EIPs among all city leaders by year, with the light green bar for the ratio of EIP party secretaries, the dark green bar for the ratio of EIP mayors, and a line for the ratio of EIP party secretaries and mayors together. We observe upward-trending patterns in both city mayors and party secretaries with past work experience related to environmental authorities and public institutions.

[Figure 1 About Here]

Panel B presents the univariate comparisons of key variables between the EIP and the non-EIP samples. At various levels, including the city-year, the firm-year, and the subsidiary-year levels, the SO_2 emission levels are statistically significantly lower in the EIP sample compared to that of the non-EIP sample. For example, at the firm-year level, the average SO_2*_Firm* for the EIP sample is 0.282 versus 0.489 for the non-EIP sample, and the difference is statistically significant at the 1% level. We also observe the differences in some other characteristics between the two groups of observations highlighting the importance in controlling for these observable characteristics in our later analysis.

4. EIPs and Local Environmental Performance

4.1 EIPs and firm SO_2 emissions

In this section, we analyze whether having an EIP affects local firms' emission levels by estimating the following regression:

$$SO_2\_Firm_{i,j,t} = \beta EIP_{j,t} + \gamma_1 CityChar_{j,t} + \gamma_2 PoliticianChar_{j,t} + \gamma_3 FirmChar_{i,t} + FirmFE + CityFE + YearFE + \varepsilon_{i,t}, \quad (1)$$

where $SO_2\_Firm_{i,j,t}$ measures the amount of total SO_2 emissions scaled by operating income adjusted for inflation for firm *i* headquartered in city *j* in year *t*; $EIP_{j,t}$ captures whether the firm's headquarters city *j* has an EIP in year *t*. We also include control variables for time-varying characteristics of the city, the politician, and the firm: $CityChar_{j,t}$ includes GDP (*Gdp*), the value-added of the secondary industry as a percentage of GDP (*Second_ind*), population (*Population*) and average wage (*Wage*); $PoliticianChar_{j,t}$ includes his/her age (*Age*), gender (*Gender*), tenure in the position (*Tenure*), and indicators for whether the politician works in his/her hometown (*Hometown*), whether the politician holds a bachelor's degree (*College*), and whether the politician holds a degree in environmental-related majors (*Edegree*); $FirmChar_{i,t}$ includes size (*Size*), firm age (*FirmAge*), leverage (*Lev*), ROA (*ROA*), ratio of tangible assets (*Tangible*), industry competition (*Competition*), SOE status (*SOE*), and the percentage of shares held by foreign shareholders (*Foreign*). We further include fixed effects for firm, city, and year to estimate within-firm effects. Year fixed effects also help to control for the time-series variations in environmental regulations and policies at the national level.

[Table 2 About Here]

Table 2 presents the results from estimating Equation (1). Column (1) reports the estimate of EIP without any control variables, but with firm, city, and year fixed effects. We observe a negative association (significant at the 1% level) between having an EIP and local firms' SO_2 emission levels. Column (2) includes control variables for the time-varying characteristics of the city, the firm, and the politician, and Column (3) further replaces the year fixed effects with industry-year fixed effects to control for possible industry-level shocks, that is, industry-level environmental policies, which can affect firm emissions differently in different industries (Cai et al., 2016). Both columns show a negative association between having an EIP and firm's SO_2 emission levels, confirming the finding in Column (1). The economic magnitude is also significant. Using the estimate in Column (2) for illustration, publicly listed firms located in a city with an EIP have a 47% (0.219/0.465) lower SO_2 emission level. Taken together, our estimates suggest that having an EIP has a negative effect on local firms' SO_2 emissions levels, consistent with our hypothesis *H1*.

Firms generally take two types of actions to reduce emission intensity. First, firms can switch to cleaner and more efficient technology to produce their products. The resulting outcome would be less emissions produced per unit of production. Second, firms can increase their abatement efforts to reduce the amount of emissions released into the environment by removing the produced pollutants. This approach is also referred to as "end-of-pipe" interventions; they do not reduce the amount of pollutant produced.

We start by testing for the potential change in the production process, which leads to lower production levels of pollutants. We define a measure, $SO_2\_Product$, as the amount of SO_2 produced (in tons) scaled by the operating income (per 1,000,000 CNY) adjusted for inflation. In Column (1) of Table 3, we find a negative but statistically insignificant coefficient estimate on the *EIP* dummy, suggesting a weakly negative relation between SO_2 produced and the presence of an EIP. The results show that firms located in cities led by EIPs produce slightly less pollutant emissions per unit of production, but it is not statistically significant.

[Table 3 About Here]

Next, we investigate changes in firm pollution abatement efforts. According to the China Statistical Yearbook on the Environment,[9] expenditures for industrial waste gas (water) treatment facilities nationwide reached 256.04 (83.72) billion yuan in 2020. Such end-of-pipe approaches are helpful in removing emissions, reducing the costs associated with emissions (e.g., fines for violating regulations, remediation costs), and enhancing overall environmental efficiency (Akey and Appel, 2021). First, we define an emission removal rate, *SO_2_Remove*, as the amount of SO_2 removed as a percentage of SO_2 produced. In Column (2) of Table 3, we find a significant and positive relation between having an EIP and the removal rate, suggesting firms located in cities led by EIPs increase emission abatement efforts to decrease the amount of pollutants being released into the environment. To directly measure abatement efforts, following He, Wang, and Zhang (2020), we use *Facility*, the number of pollutant treatment facilities, and *Capacity*, the waste gas treatment capacity over total industrial output. In Columns (3) and (4), we find that firms located in cities led by EIPs have on average 31.7% more treatment facilities and increase their maximum treatment capacity by around 58,433 standard cubic meters per hour.[10] These results confirm that, in response to the leadership of EIPs, local firms increase the number of pollutant treatment facilities and expand their treatment capacity.

Taken together, we find that firms located in cities led by EIPs have lower emissions intensity. This finding is largely driven by firms' increased abatement efforts through expanding their pollutant treatment capacity.

4.2 Addressing endogeneity issues

[9] Data source: National Bureau of Statistics of China and Ministry of Ecology and Environment of People's Republic of China.

[10] Caution should be taken when interpreting this set of results because many polluting establishments do not provide information on waste gas treatment capacity.

4.2.1 Matched sample analysis

In this section, we address the concern that certain city or firm characteristics may influence the relation between local firm emissions and EIP. For example, the appointment of EIPs is correlated with previous city-level or firm-level emissions, which may lead to endogenous matching between politicians and firms. Another explanation is that differences in firm-level emissions ex post are sourced from their differences ex ante. To further validate our main results, we conduct a matched sample analysis.

We focus on the switch sample and conduct a propensity score matching analysis to identify hypothetical counterfactual scenarios. We first identify firms that experience the turnover of city politicians from a non-EIP to an EIP as the treatment group. To avoid the endogenous selection problem that firms move their headquarters based on whether a city has an EIP, we limit our firm-year sample to firms that are located in the same city throughout the whole sample period. Furthermore, we require that the treated firm experiences only one EIP turnover within five years to avoid overlapping effects from multiple politician turnover events. After these procedures, we identify 99 switch events at the firm-level that are associated with 23 city-level switch events.[11] Then, for each of these firm-years, we identify a control firm from comparable cities at the same level (municipality, sub-provincial city or ordinary prefecture-level city) with the closest propensity score based on city characteristics including GDP (*Gdp*), population (*Population*), wage (*Wage*), and the secondary industry's value-added as a percentage of GDP (*Second_ind*), and firm characteristics including SO_2 emission level (SO_2*_Firm*), firm size (*Size*), leverage level (*Lev*), ROA (*ROA*) and firm age (*FirmAge*). These variable values are measured at the year prior

[11] At the city level, there are 54 EIP switch events. The event number reduces to 23 after matching to the public firms' sample.

to the EIP turnover. The event year for a target firm also serves as the "pseudo-event" year for its matched firm. Panel A of Table 4 shows that the characteristics of the treatment group (the switch sample) and the control group are similar.

[Table 4 About Here]

In our sample, the average years of tenure for mayors and party secretaries are 3.19 and 3.37, respectively. Therefore, in estimating the impact of EIPs on firm emissions, we focus on seven years around each event (from three years before the event to three years after the event). Control variables are the same as the main regression in Table 2 and firm, city, and year fixed effects are included. Panel B of Table 4 presents the results. In Column (1), we observe a negative and statistically significant estimated coefficient for the interaction term, *Treat×Post*, complementing our findings in the baseline model that EIPs are effective in reducing SO_2 emissions at the firm level. In Column (2), we further add event time fixed effects so that the *Post* dummy is absorbed in this specification. We continue to find a statistically significant and negative coefficient estimate on the interaction term.

In Column (3), we present the dynamic effect of EIPs on firms by augmenting the model with leads and lags of the explanatory variable. Specifically, we include dummies that capture the difference in SO_2 emission levels between the treated and the control firms for different years (with the year *t–3* as the reference category). We observe that for years before the event time, the treatment groups are not statistically significantly different from the control groups in their firm-level SO_2 emissions, collaborating the parallel trends assumption between the two groups before the treatment. Starting from the event year, the treatment firms exhibit significantly lower SO_2 emissions compared to the control firms. Furthermore, the effect of EIPs persists into the third year after the EIP becomes the leader of a city.

Taken together, our matched sample analysis focusing on the switched sample and their matched control firms confirms our finding that firms' SO_2 emissions decrease significantly after an EIP takes office and such effect persists throughout the term when the EIP is in office.

4.2.2 Determinants of EIP appointment

We next examine whether the appointment of EIPs is associated with any city characteristics, for example, the city's economic or environmental performance. We conduct the analysis at the city level by identifying all cases in which there is a change in the city leadership team and take the city-year observation that is one year prior to the change. Then we compare key characteristics of city-year observations with an incoming EIP versus those without. Panel A of Table 5 reports the results. Among the city-year observations with an incoming EIP, their city average wage is greater, while their GDP growth rate, the value-added of the secondary industry scaled by GDP, and SO_2 emission rate are slightly lower.

We further conduct multivariate analysis by estimating the following model:

$$EIP_{i,j,t+1} = \beta CityChar_{j,t} + CityFE + YearFE + \varepsilon_{i,t+1} \quad , \qquad (2)$$

where $EIP_{i,j,t+1}$ is an indicator variable that equals one if the city *j* has an incoming EIP *i* in year *t*+1, and zero otherwise; $CityChar_{j,t}$ is a set of city characteristics including city GDP (*Gdp*), GDP growth (*Gdp_growth*), population (*Population*), wage (*Wage*), the value-added of the secondary industry scaled by city GDP (*Second_ind*), SO_2 emission rate (SO_2*_City*), average PM2.5 (*PM25_City*), whether the city is on the List of Key Cities for Environmental Protection according to the Eleventh Five-Year Plan (*City_envir*), and whether the city is an ordinary prefecture-level city (*Normal*). City fixed effects and year fixed effects are included, and standard errors are clustered at the city level. We use both Logit and linear probability estimations. During our sample period from 2003 to 2020, the central government issued guidance on increasing the weight of environmental protection in local leaders' evaluation at the end of 2013 and China "declared war" on pollution in 2014. These changes might affect the factors in appointing EIPs to a particular city. Therefore, we also examine the determinants for the period before and after 2013 separately. Panel B of Table 5 reports the results. Columns (1) and (2) are for the overall sample period, Columns (3) and (4) are for the sample period before 2013, and Columns (5) and (6) are for the sample period after 2013. Across all model specifications, we observe no significant relation between city characteristics and the appointment of an EIP to a city except for the negative estimate on PM2.5 in the sample period before 2013. Overall, the results suggest that there is not a very strong selection issue in appointing an EIP to a city with particular types of characteristics.

[Table 5 About Here]

4.3 Cross-sectional variations

We further explore several cross-sectional variations where we expect the relation between EIPs and firm emissions to be stronger or weaker depending on politicians' incentives in improving local environmental performance and the tradeoffs and/or constraints they face as local politicians.

[Table 6 About Here]

First, we investigate whether a politician's being in his/her second term affects the reduction in emissions. Li and Zhou (2005) argue that leaders in their second term in the same position have a disadvantage in gaining a promotion, which reduces their incentives to perform well, including their incentive to improve the local environment. We define a politician as being in his/her second term if he/she has been in the position for more than five years (*SecondTerm*=1).

To empirically estimate the effect of these factors, we augment Equation (1) with the interaction term *SecondTerm×EIP*. Column (1) of Table 6 displays the results. Consistent with our hypothesis, the estimated coefficient on the interaction term is positive. This effect is economically significant: the interaction term cancels out the negative effect of EIPs on firm emissions. This finding suggests that politicians' career advancement likelihood affects his/her incentives and thus the effectiveness of an EIP in improving local environmental performance.

Second, we examine the effect of the economic importance of a firm in affecting the relation between the EIP and firm emissions. City officials are evaluated on both economic performance and environmental performance. There is evidence on the economic costs of environmental protection (He, Wang, and Zhang, 2020; Zhang, 2021). Therefore, we hypothesize that the effect of having an EIP on SO_2 emissions may be smaller for economically important firms. We define a firm as economically important (*Pillar =1*) if the firm's operating income to the city's GDP is greater than the sample median in the prior year. Column (2) of Table 6 shows that the coefficient estimate of the interaction term of *Pillar ×EIP* is positive, indicating a weaker effect in emissions reduction among economically important firms. This finding suggests that economically important firms face less scrutiny on their environmental performance.

Taken together, the effectiveness of an EIP in local firms' environmental performance varies with the politician's incentives and the type of firms, lending further support to the causal effect of EIPs on environmental governance. The weaker relation between EIPs and environmental performance when politicians' career advancement motives are lower and when firms are economically more important supports the strategic channel and hypothesis *H2a*.

4.4 Mechanisms

Next, we explore several mechanisms through which we observe the negative relation between a government having an EIP and local firms' emission levels. We investigate from two distinct but complementary perspectives—the deterrence of environmental violations and the provision of government subsidies to support green projects.

4.4.1 Environmental violations

First, we investigate whether EIPs better detect environmental violations and therefore reduce firms' propensity to violate environmental regulations in the first place. The environmental policies of industrialized countries commonly punish firms for regulatory violations, which improve environmental quality (Kagan, Gunningham and Thornton, 2003; Earnhart, 2004; Gray and Shimshack, 2011; Dasgupta, Huynh, and Xia, 2023). Therefore, we explore whether EIPs improve firms' environmental performance through enforcement activities. We manually collect environmental violations data from websites of municipal ecology and environment bureaus and the PKULaw Database (https://pkulaw.com/) from 2003 to 2018. Violations information includes the entity name, the sanction date, and the specific enforcement agency. Examples of environmental violations include excessive discharge of pollutants, non-compliance with environmental disclosure requirements, etc.[12] We end the sample period in 2018 for sample completeness because it often takes some time from when a violation is committed to when it is detected.[13]

In any violation sample there is a partial observability problem. That is, we only observe detected violations, not the whole population of violations. Detected violations depend on two

[12] For example, in 2013 the "New North Zone," a subsidiary of Chongqing Brewery Co.,Ltd (600132.SH), was fined 12,479,400 yuan by the Chongqing Municipal Environmental Supervision Office for illegally discharging 1,517,100 tons of sewage from February 2009 to May 2013.

[13] Khanna, Kim, and Lu (2015) show that it takes an average of two to three years to detect a fraud from when it occurred.

distinct but latent processes—the commission of violations and the detection of violations. We follow Wang, Winton, and Yu (2010), Wang (2013), and Khanna, Kim, and Lu (2015) by employing a bivariate probit model to estimate the factors that determine violation detection and violation commission. We define *Detect_local* as an indicator for whether the firm is sanctioned by *local* municipal environmental authorities, and *Detect_nonLocal* as an indicator for whether the local firm is sanctioned by *non-local* environmental authorities. Respectively, we construct two indicator variables, *Violation_Local* and *Violation_nonLocal*, for violation commissions.

Our common set of variables explaining a firm's likelihood of committing violation and being detected first include all control variables that are used in Equation (1) to predict a firm's emission levels given that excessive emissions constitute a large proportion of corporate environmental violations.[14] We further include an indicator for whether the city is on the List of Key Cities for Environmental Protection according to the Eleventh Five-Year Plan for National Environmental Protection because greater attention from the central government might lead to stricter environmental enforcement in those cities. Following Wang, Winton, and Yu (2010), we include the median Tobin's Q of industry to proxy for industry-level litigation risk that violations are more likely to get caught when investigators and investors are looking closely into the industry. Finally, prior literature shows that external and internal governance affects corporate environmental litigation risk and thus a firm's incentives in conducting fraud. Therefore, as proxy measures for external governance quality, we include indicators for whether a firm is audited by a Big Four accounting firm (Du et al., 2018), the percentage of shares held by institutional investors (Fernando et al., 2017), and the logarithm of the number of analysts following (Chen, Harford, and

[14] http://www.xinhuanet.com//english/2017-06/11/c_136356860.htm

Lin, 2015; Luo et al., 2015). As a proxy measure for internal governance quality, we include the percentage of independent directors (Kassinis and Vafeas, 2002).

The bivariate probit model estimation requires that the commission and detection estimations do not contain the same set of variables. Therefore, for estimating the likelihood of violation commission, we include the percentage of shares held by executives in the estimating equation. Firm violations are highly correlated with the degree of alignment between managers and firms, but there is little evidence that such incentives affect a firm's probability of being detected by authorities (Johnson, Ryan and Tian., 2009; Wang, Winton and Yu 2011). Furthermore, we include a few extra variables that are associated with a firm's likelihood of being detected as suggested by the literature. First, Khanna, Kim, and Lu (2015) shows that fraudulent activity by higher-growth firms is more likely to be detected because these firms attract more investor attention. Second, the litigation literature (e.g., Jones and Weingram, 1996; Wang, Winton, and Yu, 2010) suggests that stock returns are related to a firm's litigation risk. Third, we conjecture that the proportion of businesses conducted locally might also affect a local government's supervision of the firm. Therefore, we include growth rate in operating income, annual stock returns, and the proportion of local subsidiaries in the estimating equation of violation detection.

[Table 7 About Here]

Panel A of Table 7 reports the results. In the sample of environmental violations detected by local environmental authorities, Column (1) shows that EIPs are negatively related to the propensity of committing violations, and Column (2) shows that EIPs are positively related to the probability of violation detection. Both estimates are statistically significant at least at the 5% level. These estimates suggest that a firm located in a city with an EIP faces a higher probability of violation detection and a lower propensity to commit violations compared to a firm located in a city without an EIP. Furthermore, we examine this relation in the violations sample detected by non-local or central environmental authorities. Results in Columns (3) and (4) suggest that the detection probability in the non-local sample is not statistically significant anymore although the overall likelihood of conducting environmental violations is still reduced.

4.4.2 Green subsidies

Government subsidies are a common economic intervention tool governments around the world use to meet social policy objectives (Schwartz and Clements, 1999). Subsidies can be in the form of grants (non-repayable sums of money), tax relief, or loans. Green subsidies are direct government financial support given to firms as an incentive to promote green manufacturing and sustainable development or to offset the costs of mandatory environmental standards. Acemoglu et al. (2012, 2016) highlight the importance of subsidies in directing technical changes toward clean technology and avoiding excessive use of carbon taxes. Xu and Kim (2022) also highlight the importance of financial resources in environmental decisions that firms actively trade off abatement costs against potential legal liabilities. In this section, by utilizing detailed firm-level subsidies data, we investigate whether EIPs use green subsidies as a tool to promote local greenness.

In 2006, the China Securities Regulatory Commission (CSRC) implemented a new set of reporting and accounting rules that require companies listed on any of China's stock exchanges to disclose all direct government subsidies received, along with a brief description of the nature of these subsidies (Fang et al., 2022; Branstetter, Li, and Ren, 2022). For the period from 2007 to 2020, we manually collect the information on government subsidies received by firms from the footnotes of their annual reports. To identify green subsidies, we first construct a dictionary of environment-related words from the Report of the State Council on Environmental Protection Work (2003–

2021).[15] After filtering the list of subsidies containing the words/phrases from the dictionary, we manually go through the list to weed out misidentified records. Through the manual process, we also identify the funding source of subsidies to determine whether the subsidy is funded by the central, the provincial, or the municipal government.[16]

Green subsidies are pervasive in China, and the resources involved in subsidies are sizable. From our estimates, as of 2016, the central government spent around $1.8 billion (12 billion CNY) a year on green subsidies to non-financial listed firms, reaching a peak in our sample period. For our purposes of analyzing the effect of city EIPs on firms' green subsidies, we focus on the sample of subsidies received from the local government where city leaders potentially have greater control. Specifically, for each firm-year, we define *Sub_Local1* as green subsidies a firm receives from the local (municipal) government divided by its total assets, *Sub_Local2* as the same numerator but scaled by operating income as denominator, and *Sub_Local3* as the natural logarithm of the total amount of green subsidies from the local government. Panel B of Table 7 reports the results examining the relation between green subsidies and city EIPs. Columns (1) – (3) show that compared to firms located in cities without EIPs, firms located in cities with EIPs receive an increased amount of green subsidies from the local government, using either the scaled measures or the raw amount received.

If the firms located in cities with EIPs are systematically better at applying and obtaining green subsidies from the government, the above results might be driven by differences in the firms rather than in the city leaders. Therefore, to rule out the possibilities that the effect is not specific

[15] See Appendix B for the list of environment-related key words and their corresponding English translations.
[16] For example, in the 2020 annual report of Shenzhen Salubris Pharmaceuticals Co., Ltd., the firm disclosed a government subsidy of 1,359,323.00 CNY called "Subsidies for atmospheric environmental quality improvement from Shenzhen Municipal Bureau of Ecology and Environment." In the 2020 annual report of Guangxi Fenglin Wood Industry Group Company Limited, the firm disclosed a government subsidy of 27,934,209.51 CNY called "Refund income of VAT for comprehensive utilization of resources."

to local EIPs, we construct a measure, *Sub_nonLocal*, to capture the part of subsidies a firm receives from other cities. Column (4) of Table 7 reports the results. We find an insignificant estimated coefficient on the *EIP* dummy in this sample, suggesting that firms do not receive more green subsidies from non-local cities. This piece of evidence helps to rule out the possibility that firms located in cities with EIPs universally benefit more from green subsidies.

Taken together, these findings suggest that EIPs encourage local companies to reduce SO_2 emissions through both deterring non-compliance and financial support. These mechanisms potentially complement each other in improving local firm's environmental performance.

4.5 Subsidiary-level analysis

Our analysis so far has focused on the firm level where we aggregate the emissions at the establishment level up to the firm level. In this section, we further investigate the effect of EIPs at the subsidiary level. The purpose of this section is twofold. First, subsidiary-level analysis provides a robustness check to our results using firm-level information. Second, and more importantly, subsidiaries are potentially located at different locations with different environmental policy requirements and/or different levels of enforcement, which allows us to explore firm's internal strategies in managing and/or allocating pollutant emissions across subsidiaries.[17] Specifically, we first explore whether the reduction in emissions is different for local and non-local subsidiaries. Second, we investigate site selection decisions for companies that need to build new polluting facilities.

[17] Politicians are mainly responsible for local environment performance. For example, according to Measures for the Accountability of Party and Government Leaders for Damage to the Ecological Environment (for Trial Implementation), "The local Party committees and governments at various levels shall assume the overall responsibilities for the conservation of the local ecological environment and resources, the major leaders of the Party committees and governments shall assume the primary responsibilities and other relevant leaders shall assume the corresponding responsibilities within the scope of their functions" (https://www.gov.cn/zhengce/2015-08/17/content_2914585.htm (in Chinese).

4.5.1 Spillover effects on non-local subsidiaries

To analyze the effect of EIPs on firms at the subsidiary level, we re-estimate Equation (1) using subsidiary-level emissions data. We further include subsidiary fixed effects and the fixed effects for the city in which the subsidiary is located. Column (1) of Table 8 reports the results. The *EIP* indicator is for whether the subsidiary's parent firm is headquartered in a city with EIP leadership. Consistent with firm-level evidence, we find a negative and statistically significant coefficient estimate on the *EIP* indicator. We further investigate whether this effect only comes from local establishments that are located in the same city as the parent firm. Therefore, we split the sample of establishments into a local group and a non-local group and estimate the effect of EIPs in each group separately. Columns (2) and (3) report the results. We observe a negative and statistically significant estimated coefficient on the EIP indicator for both groups of establishments. These results suggest that the effect of EIPs on firm SO_2 emissions is not only local but also spills over to firms' establishments located in other cities.

[Table 8 About Here]

Chen et al. (2021) and Bartram, Hou, and Kim (2022) document that firm-specific and region-specific environmental policies lead to emissions and output shifts due to regulatory arbitrage strategies enacted by firms. Our findings complement these studies to uncover a positive spillover effect of EIPs on non-local establishments of the public firms and suggest a more effective environmental regulatory approach.

4.5.2 Site selection for new polluting subsidiaries

Given our evidence that firms reduce pollutant emissions when their headquarters city has an EIP, we further explore whether having an EIP at a firm's headquarters location affects firms' decisions about whether and where to establish new polluting subsidiaries.[18] Information on subsidiaries of public firms is obtained from the CNRDS database. CNRDS collects subsidiaries information mainly from the public firms' periodic reports; we supplement the information with NECIPS (National Enterprise Credit Information Publicity System) of China. Information on subsidiaries includes the subsidiary's name, location, and establishment date. We use the establishment date to identify the year when the subsidiary was established. Furthermore, following He, Wang, and Zhang (2020), we categorize subsidiaries into polluting industries and non-polluting industries based on the classification in the Environmental Information Disclosure Handbook of Listed Firms issued by the Ministry of Ecology and the Environment, which the China Securities Regulatory Commission (CSRC) also uses in the Environmental Inspection Categories of Listed Firms.

To test whether and where firms set up new polluting subsidiaries, at the firm-year level, we create four indicator variables for whether firms set up new polluting subsidiaries in the parent firm's city (local), in other cities (non-local), in other cities with no EIP (non-local and non-EIP), and other cities with an EIP (non-local and EIP). We separately estimate the effect of having an EIP at the parent firm's city on the firms' location choices in establishing polluting establishments using the four indicators and results presented in Columns (1) - (4) of Table 9, respectively.

[Table 9 About Here]

We observe a negative and statistically significant coefficient estimate on the *EIP* dummy in Column (1) and a positive and significant coefficient estimate in Column (2), which suggest that when a firm's headquartered city has an EIP, firms are less likely to set up new polluting

[18] Using plant-level data for U.S. manufacturing industries from 1990 to 2007, Cui and Moschini (2020) show that multi-plant firms are more likely to shut down dirty plants in response to increasingly stringent environmental regulations at the county level compared to single-plant firms. The effect is stronger with the presence of more sibling plants residing in neighboring counties that are free from regulatory controls.

subsidiaries locally but more likely to set up new polluting subsidiaries non-locally. Furthermore, we observe a positive and significant coefficient estimate in Column (3), which suggests that firms are more likely to establish new polluting subsidiaries in a non-local city with no EIPs; in addition, we observe a positive but not statistically significant coefficient in Column (4), suggesting that the effect is much smaller and not statistically significant in non-local cities with EIPs. In untabulated results, we continue to find similar patterns in the subsample of polluting public firms and after controlling for city-level and politician-level characteristics of the subsidiary city.

Taken together, these results suggest that firms make strategic decisions when selecting cities for new polluting subsidiaries, taking into account local environmental requirements and the relative intensity of enforcement across locations.

5. Analysis of Politicians' Career Advancement

In this section, we examine whether environmental performance affects a politician's career advancement probability and whether this relation depends on whether the politician is an EIP. To begin, we present evidence on the relation between having an EIP as the city leader and the city's environmental and economic performance. Then, we investigate the relation between promotion and local performance, as well as the time-series variations in the relation.

5.1 City-level environmental and economic performance

Having an EIP reduces local firms' emissions. In this section, we further explore the relation between EIPs and city-level environmental performance. At the city level, we observe more types of pollutants to measure its environmental performance, including the natural logarithm of GDP-adjusted industrial SO_2 emissions (in tons), the natural logarithm of GDP-adjusted industrial dust emissions (in tons), the average PM2.5 level in a year, the average daily NO_2

concentration in a year, and the natural logarithm of GDP-adjusted industrial sewage discharge (in 10,000 tons).

[Table 10 About Here]

We estimate a model in which the dependent variables are the different environmental performance measures, and the key independent variable is whether a city has an EIP. We further control for city and politician characteristics that are the same as those in Equation (1), as well as city and year fixed effects. Panel A of Table 10 reports the results. We find a statistically significant negative relation between the city's SO_2, CO_2, NO_2, and industrial sewage discharge levels and EIPS, suggesting that having an EIP is effective in reducing the city's overall pollutant emissions. To shed light on the potential channels, we find that cities with EIPs have more discussions on environmental issues in their government working reports, make more green investments, and have stricter environmental violation enforcement. Appendix C reports the related results.

Furthermore, we examine the relation between a city's economic performance and the presence of an EIP in a city. In Panel B of Table 10, we find that there is no significant relation between the *EIP* dummy and city-level economic outcomes measured by the growth rate of local GDP or GDP per capita, suggesting that EIPs do not perform differently on economic matters from non-EIPs.[19] These findings support the strategic channel and are consistent with hypothesis *H3a*.

5.2 Politician promotion analysis

Next, we investigate factors affecting a politician's likelihood of career advancement and whether that differs for EIPs and non-EIPs. Following Wang, Zhang, and Zhou (2020), a politician

[19] We also analyze the relation between having an EIP and local firms' financial performance. We measure a firm's financial performance using ROA, ROS, Tobin's Q, and abnormal return adjusted with industry average. Across all performance measures, we do not find a significant relation between having an EIP as a local leader and local public firm's performance.

is regarded as being promoted if he/she is transferred after their current term (1) from the prefecture level to the deputy province-level, the provincial level, the politburo level; or (2) from the deputy province level to the provincial level or politburo level; or (3) from the provincial level to the politburo level (all of those politicians are from the four provincial-level cities); or (4) to positions at the same level but with greater power, for example from mayor to CPC secretary.

For factors affecting the likelihood of a politician's promotion, we consider the city's average economic and environmental performance over his/her tenure. We further consider the interaction effect between *EIP* and economic and environmental performance to entertain the possibility that EIPs might be evaluated differently from non-EIPs. We hypothesize that EIPs might be evaluated with more weight on his/her environmental performance compared to non-EIPs who might be evaluated with more emphasis on economic performance. To test these hypotheses, we estimate the following model:

$$\begin{aligned} Promotion_{i,j,t} = {} & \alpha_1 EIP_{i,j,t} + \alpha_2 EconPerf_{j,t} + \alpha_3 EconPerf_{j,t} \times EIP_{i,j,t} + \alpha_4 EnvirPerf_{j,t} \\ & + \alpha_5 EnvirPerf_{j,t} \times EIP_{i,j,t} + CityChar_{j,t} + PoliticianChar_{i,t} \\ & + CityFE + YearFE + PositionFE + \varepsilon_{i,j,t} \end{aligned} , \quad (3)$$

where $Promotion_{i,j,t}$ is an indicator variable that equals one if the EIP *i* of city *j* is promoted in his/her next position, and zero otherwise; $EIP_{i,j,t}$ is an indicator variable that equals one if the politician *i* of city *j* is an EIP politician in year *t*, and zero otherwise; $EconPerf_{j,t}$ is the average GDP growth rate since the city leader takes over the current position; $EnvirPerf_{j,t}$ is the negative value of the mean logarithm of a city's industrial SO_2 emission divided by the city's GDP during a politician's tenure, since the city leader takes over the current position. $CityChar_{j,t}$ and $PoliticianChar_{i,t}$ are the same set of control variables as in Equation (1). Following Li and Zhou (2005), we further include the square term of the EIP's tenure for the possible non-linear relation between promotion and the time a politician stays in the current position. Typically, a politician stays in a position for some time before being promoted. However, if the EIP stays in his/her current position for too long, the likelihood of promotion decreases. City fixed effects, year fixed effects, and position fixed effects are further included, and standard errors are clustered at the politician level.

[Table 11 About Here]

Table 11 reports the results. In Column (1), we include an economic performance measure and its interaction term with the *EIP* dummy. We do not find that economic performance affects the likelihood of a politician's promotion in the overall sample period. In Column (2), we further consider the impact of environmental performance on promotion likelihood by only including the environmental performance measure and its interaction term with the *EIP* dummy. We find a positive and statistically significant coefficient estimate on the interaction term between *EIP* and local environmental performance. This finding suggests that, for an EIP, his/her promotion likelihood is greater if the environmental performance of the city he/she oversees is better. In other words, the city's environmental performance affects an EIP's promotion likelihood. In Column (3), we include both economic and environmental performance factors. We continue to find that better environmental performance is positively related to an EIP's promotion likelihood.

As discussed in the institutional background section, the central government issued guidance on increasing the weight of environmental protection in local leaders' evaluations at the end of 2013, and China "declared war" on pollution in 2014. These changes might have led to changes in the factors affecting the promotion of government officials. Therefore, we further split our sample into a pre-2013 period and a post-2013 period (including 2013) and repeat our analysis. Columns (4) and (5) report the results. In the periods prior to 2013, we notice that there is a positive and statistically significant estimate on the interaction term between the *EIP* dummy and local economic performance, suggesting that an EIP's promotion likelihood is linked to his/her economic performance. For the post-2013 period, we notice that there is a positive and statistically significant estimate on the *EIP* dummy, suggesting that an EIP has a greater chance of being promoted in the more recent period. However, we no longer observe a significant relation between economic performance and the EIPs' promotion likelihood, but rather a positive estimate on the interaction term between the *EIP* dummy and local environmental performance. These findings suggest a change in evaluation focus for EIPs from the pre-2013 to post-2013 periods. The change is consistent with the increased weight being given to environmental performance in local officials' performance evaluations to better combat the environmental issues.

The above evidence suggests that economic performance is a more important factor in determining a politician's promotion likelihood in the pre-2013 period. During the sample period, many city leaders also had experience working in economy-related government departments, which we refer to as economically inclined politicians (ECIPs). Specifically, ECIPs are defined as city leaders with prior work experience at either any level of a government department responsible for economic affairs or other government agencies and economic research institutes with responsibility for formulating economic development plans and giving general guidance to economic activities. Whether economic and environmental performance play different roles in the promotion of EIPs and ECIPs and how the relations change over time are interesting questions to investigate. Therefore, we augment regression (3) with the *ECIP* dummy variable and its interaction terms with *EconPerf* and *EnvirPerf* measures and re-estimate the effects. Columns (6) - (8) report the estimation results for the overall sample period, before 2013 and after 2013, respectively. Results show that both EIPs and ECIPs with better economic performance are more likely to be promoted before 2013. However, for the period after 2013, the link between economic performance and promotion becomes weak for both EIPs and ECIPs, while EIPs with better environmental performance are more likely to be promoted after 2013.

Taken together, results show that economic performance is more important in politicians' promotion for the period before 2013, while environmental performance becomes more important after 2013, especially for EIPs. The changes reflect the implementation of the concept of "clear waters and lush mountains are invaluable assets" in the performance evaluations of local officials. Furthermore, the findings suggest that EIPs are evaluated with more weight on environmental performance compared to non-EIPs in the post-2013 period.

6. Conclusions

In this study, we demonstrate that local politicians with prior environment-related work experience are associated with lower levels of SO_2 emissions at both the firm and city level. Firm-level evidence suggests that firms respond to incoming EIPs by increasing pollutant abatement efforts to reduce pollutant emissions released into the environment. We further find that firms in cities with EIPs receive more green subsidies from the local government and are less likely to commit environmental violations. Furthermore, the effect of EIPs reducing SO_2 emissions is not restricted to establishments in the local city but extends to its subsidiaries in other cities; however, parent companies located in cities with EIPs are more likely to establish polluting subsidiaries in cities without EIPs. Evidence also suggests that EIPs strategically consider the tradeoffs between economic and environmental performance. First, the relation between EIPs and environmental performance is attenuated when politicians are less likely to be promoted in their second term and when a firm is economically important to the city governed by an EIP. Second, the economic performance of the city governed by EIPs is not statistically different from that of the city governed by non-EIPs. Finally, we find that EIPs' likelihood of promotion is linked to their environmental performance, indicating that politicians' characteristics and expertise are factored into their performance evaluations.

References

Acemoglu, D., P., Aghion, L. Bursztyn, & Hemous, D. (2012). The environment and directed technical change. *American Economic Review*, 102(1), 131–166.

Acemoglu, D., U., Akcigit, D., Hanley, & Kerr, W. (2016). Transition to clean technology. *Journal of Political Economy*, 124(1), 52–104.

Akey, P., & Appel, I. (2021). The limits of limited liability: Evidence from industrial pollution. *The Journal of Finance*, 76(1), 5–55.

Azar, J., Duro, M., Kadach, I., & Ormazabal, G. (2021). The Big Three and corporate carbon emissions around the world. *Journal of Financial Economics*, 142(2), 674–696.

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

Bartram, S. M., Hou, K., & Kim, S. (2022). Real effects of climate policy: Financial constraints and spillovers. *Journal of Financial Economics*, 143(2), 668–696.

Bradley, D., Gokkaya, S., & Liu, X. (2017). Before an analyst becomes an analyst: Does industry experience matter? *The Journal of Finance*, 72(2), 751–792.

Branstetter, L. G., Li, G., & Ren, M. (2022). Picking winners? Government subsidies and firm productivity in China. NBER working paper.

Brown, J. R., Martinsson, G., & Thomann, C. (2022). Can environmental policy encourage technical change? Emissions taxes and R&D investment in polluting firms. *The Review of Financial Studies*, 35(10), 4518–4560.

Cai, X., Lu, Y., Wu, M., & Yu, L. (2016). Does environmental regulation drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China. *Journal of Development Economics*, 123, 73–85.

Chen, Q., Chen, Z., Liu, Z., Serrato, J. C. S., & Xu, D. (2021). Regulating conglomerates in China: Evidence from an energy conservation program. NBER working paper.

Chen, T., Harford, J., & Lin, C. (2015). Do analysts matter for governance? Evidence from natural experiments. *Journal of Financial Economics*, 115(2), 383–410.

Chen, T., & Kung, J. K.-S. (2016). Do land revenue windfalls create a political resource curse? Evidence from China. *Journal of Development Economics*, 123, 86–106.

Chen, Y. J., Li, P., & Lu, Y. (2018). Career concerns and multitasking local bureaucrats: Evidence of a target-based performance evaluation system in China. *Journal of Development Economics*, 133, 84–101.

Chu, Y., & Zhao, D. (2019). Green hedge fund activists. Working paper.

Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of US environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal*, 43(4), 627–641.

Cui, J., & Moschini, G. (2020). Firm internal network, environmental regulation, and plant death. *Journal of Environmental Economics and Management*, 101, 102319.

Custódio, C., & Metzger, D. (2014). Financial expert CEOs: CEO′s work experience and firm's financial policies. *Journal of Financial Economics*, 114(1), 125–154.

Dewatripont, M., Jewitt, I., & Tirole, J. (1999). The economics of career concerns, Part II: Application to missions and accountability of government agencies. *Review of Economic Studies*, 66, 199–217.

Dai, R., H. Liang, and L. Ng. (2021). Socially responsible corporate customers. *Journal of Financial Economics* 142, 598–626.

Du, X., Jian, W., Zeng, Q., & Chang, Y. (2018). Do auditors applaud corporate environmental performance? Evidence from China. *Journal of Business Ethics*, 151(4), 1049-1080.

Dasgupta, S., Huynh, T.D., & Xia, Y. (2023). Joining forces: The spillover effects of EPA enforcement actions and the role of socially responsible investors. *The Review of Financial Studies*, forthcoming.

Earnhart, D. (2004). Regulatory factors shaping environmental performance at publicly-owned treatment plants. *Journal of Environmental Economics & Management*, 48(1), 655–681.

Fang, H., Li, Z., Xu, N., & Yan, H. (2022). Firms and local governments: Relationship building during political turnovers. *Review of Finance*, 1, 24.

Fang, L., Lerner, J., Wu, C., & Zhang, Q. (2022). Anticorruption, government subsidies, and innovation: Evidence from China. *Management Science,* forthcoming.

Fernando, C. S., Sharfman, M. P., & Uysal, V. B. (2017). Corporate environmental policy and shareholder value: Following the smart money. *Journal of Financial and Quantitative Analysis*, 52(5), 2023–2051.

Gao, M., & Huang, J. (2022). Corporate capture of Congress in carbon politics: Evidence from roll call votes. Working paper.

Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889.

Gray, W. B., & Shimshack, J. P. (2011). The effectiveness of environmental monitoring and enforcement: A review of the empirical evidence. *Review of Environmental Economics and Policy*, 5(1), 1–23.

Greenstone, M. (2012). The impacts of environmental regulations on industrial activity: Evidence from the 1970 and 1977 Clean Air Act amendments and the census of manufacturers. *Journal of Political Economy*, 110(6):1175–1219.

Greenstone, M., G. He, S. Li, and E. Y. Zou. (2021). China's war on pollution: Evidence from the first 5 years. *Review of Environmental Economics and Policy,* 15 (2), 281–99.

He, G., Wang, S., Zhang, B. (2020). Watering down environmental regulation in China. *Quarterly Journal of Economics*, 135(4), 2135–2185.

Holmstrom, B. & Milgrom, P. (1991). Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics, and Organization*, 7, 24–52.

Hong, H., Karolyi, G. A., & Scheinkman, J. A. (2020). Climate finance. *The Review of Financial Studies*, 33(3), 1011-1023.

Jin, Y., Andersson, H., & Zhang, S. (2016). Air pollution control policies in China: A retrospective and prospects. *International Journal of Environmental Research and Public Health*, 13(12), 1219.

Johnson, S. A., Ryan, H. E., & Tian, Y. S. (2009). Managerial incentives and corporate fraud: The sources of incentives matter. *Review of Finance*, 13(1), 115–145.

Jones, C. L., & Weingram, S. E. (1996). The determinants of 10b-5 litigation risk. Working paper.

Kagan, R. A., Gunningham, N., & Thornton, D. (2003). Explaining corporate environmental performance: How does regulation matter? *Law & Society Review*, 37(1), 51–90.

Kahn, M. E., Li, P., & Zhao, D. (2015). Water pollution progress at borders: The role of changes in China's political promotion incentives. *American Economic Journal: Economic Policy*, 7(4), 223–242.

Karplus, V. J., Zhang, S., & Almond, D. (2018). Quantifying coal power plant responses to tighter SO2 emissions standards in China. *Proceedings of the National Academy of Sciences*, 115(27), 7004-7009.

Karplus, V. J., Zhang, J., & Zhao, J. (2021). Navigating and evaluating the labyrinth of environmental regulation in China. *Review of Environmental Economics and Policy*, 15(2), 300–322.

Kassinis, G., & Vafeas, N. (2002). Corporate boards and outside stakeholders as determinants of environmental litigation. *Strategic Management Journal*, 23(5), 399–415.

Khanna, V., Kim, E. H., & Lu, Y. (2015). CEO connectedness and corporate fraud. *The Journal of Financ*e, 70(3), 1203–1252.

Kim, I., Wan, H., Wang, B., & Yang, T. (2019). Institutional investors and corporate environmental, social, and governance policies: Evidence from toxics release data. *Management Science*, 65(10), 4901–4926.

Kirkland, P. A. (2021). Business owners and executives as politicians: The effect on public policy. *The Journal of Politics*, 83(4), 1652–1668.

Malmendier, U., & Wachter, J. A. (2022). Memory of past experiences and economic decisions. Working paper.

Lewis, B. W., Walls, J. L., & Dowell, G. W. (2014). Difference in degrees: CEO characteristics and firm environmental disclosure. *Strategic Management Journal*, 35(5), 712–722.

Li, H., & Zhou, L.-A. (2005). Political turnover and economic performance: The incentive role of personnel control in China. *Journal of Public Economics*, 89(9), 1743–1762.

Li, J., Shi, X., Wu, H., & Liu, L. (2020). Trade-off between economic development and environmental governance in China: An analysis based on the effect of river chief system. *China Economic Review*, 60, 101403.

Lin, L. (2013). Enforcement of pollution levies in China. *Journal of Public Economics*, 98,32–43.

Liu, Z., Shen, H., Welker, M., Zhang, N., Zhao, Y. (2021). Gone with the wind: An externality of earnings pressure. *Journal of Accounting and Economics*, 72(1), 101403.

Luo, X., Wang, H., Raithel, S., & Zheng, Q. (2015). Corporate social performance, analyst stock recommendations, and firm future returns. *Strategic Management Journal*, 36(1), 123–136.

Raff, Z., Meyer, A., & Walter, J. M. (2022). Political differences in air pollution abatement under the Clean Air Act. *Journal of Public Economics*, 212, 104688.

Schwartz, G., & Clements, B. (1999). Government subsidies. *Journal of Economic Surveys*, 13(2), 119-148.

Shi, Y., Wu, J., & Zhang, Y. (2022). Green image in supply chains: Selective disclosure of green suppliers. Working paper.

Shive, S. A., & Forster, M. M. (2020). Corporate governance and pollution externalities of public and private firms. *The Review of Financial Studies*, 33(3), 1296-1330.

Stoerk, T. (2018). Effectiveness and cost of air pollution control in China. Working paper.

Szakonyi, D. (2021). Private sector policy making: business background and politicians' behavior in office. *The Journal of Politics*, 83(1), 260–276.

Walker, W.R. (2013). The transitional costs of sectoral reallocation: Evidence from the clean air act and the workforce. *The Quarterly Journal of Economics*, 128(4), 1787–1835.

van Donkelaar, A., Hammer, M. S., Bindle, L., Brauer, M., Brook, J. R., Garay, M. J., Hsu, N. C., Kalashnikova, O. V., Kahn, R. A., Lee, C., Levy, R. C., Lyapustin, A., Sayer, A. M., & Martin, R. V. (2021). Monthly global estimates of fine particulate matter and their uncertainty. *Environmental Science & Technology*, 55(22), 15287–15300.Walker, W.R. (2013). The transitional costs of sectoral reallocation: Evidence from the Clean Air Act and the workforce. *The Quarterly Journal of Economics*, 128(4), 1787–1835.

Wang, T. Y. (2013). Corporate securities fraud: Insights from a new empirical framework. *Journal of Law, Economics, and Organization*, 29(3), 535–568.

Wang, T. Y., Winton, A., & Yu, X. (2010). Corporate fraud and business conditions: Evidence from IPOs. *The Journal of Finance*, 65(6), 2255–2292.

Wang, Z., Zhang, Q., & Zhou, L.-A. (2020). Career incentives of city leaders and urban spatial expansion in China. *The Review of Economics and Statistics*, 102(5), 897–911.

Wu, M., & Cao, X. (2021). Greening the career incentive structure for local officials in China: Does less pollution increase the chances of promotion for Chinese local leaders? *Journal of Environmental Economics and Management*, 107, 102440.

Xu, Q., & Kim, T. (2022). Financial constraints and corporate environmental policies. *The Review of Financial Studies*, 35(2), 576–635.

Yao, Y., & Zhang, M. Y. (2013). Performance of officials and the promotion tournament: Evidence from Chinese Cities. *Economic Research Journal* (in Chinese), 1, 137–150.

Zhang, B., Cao, C., Gu, J., & Liu, T. (2016). A new environmental protection law, many old problems? Challenges to environmental governance in China. *Journal of Environmental Law*, 28(2), 325–335.

Zhang, P. (2021). Target interactions and target aspiration level adaptation: How do government leaders tackle the "environment – economy" nexus? *Public Administration Review*, 81(2), 220–230.

Zhi, W. (2021). Will nature-loving CEOs make the world greener? Working paper.

Appendix A: Variable Definitions

Variable	Definition	Source
Panel A: Politician- & City-Level Variables		
EIP	An indicator variable equals one if the politician (mayor/CPC secretary) has previous environmental work experience, and zero otherwise. Environmental work experience includes work experience: (1) in all levels of government departments responsible for ecological and environmental affairs; (2) in other government agencies and environmental research institutes responsible for protecting natural resources, energy savings, and emission reduction, etc.; (3) as mayor or deputy mayor responsible for regional environmental protection and such duties are clearly documented in government documents.	Hand-collected
ECIP	An indicator variable equals one if the politician (mayor / CPC secretary) has prior economic work experience, and zero otherwise. Economic work experience includes work experience at: (1) all levels of government departments responsible for economic affairs; (2) other government agencies and economic research institutes with functions of formulating economic development plans and giving general guidance to economic activities.	Hand-collected
Age	The natural logarithm of the politician's age.	Hand-collected
Gender	An indicator variable equals one if the politician is female, and zero otherwise.	Hand-collected
Hometown	An indicator variable equals one if the politician was born in the city where he works, and zero otherwise.	Hand-collected
College	An indicator variable equals one if the politician has a bachelor's degree or higher, and zero otherwise.	Hand-collected
Edegree	An indicator variable equals one if the politician graduated with a degree in an environment-related major, and zero otherwise.	Hand-collected
Econ_degree	An indicator variable equals one if the politician graduated with a degree in an economics-related major, and zero otherwise.	Hand-collected
Mayor_deputy	An indicator variable equals one if the politician has previously worked as a deputy mayor, and zero otherwise.	Hand-collected
Tenure	The natural logarithm of years since the politician took office.	Hand-collected
Tenure_sq	The square of the number of years since the politician took office.	Hand-collected
SecondTerm	An indicator variable equal to one if the leader has been in the position for more than five years (following Li and Zhou (2005)), and zero otherwise.	Hand-collected
Gdp	GDP adjusted for inflation.	China City Yearbook & National Bureau of Statistics of China

Gdp_growth	GDP growth rate adjusted for inflation.	China City Yearbook & National Bureau of Statistics of China
PCGdp_growth	The growth rate of GDP per capita adjusted for inflation.	China City Yearbook & National Bureau of Statistics of China
Second_ind	The value-added of the secondary industry as a percentage of GDP.	China City Yearbook
Population	The natural logarithm of city population.	China Urban-Rural Construction Statistical Yearbook
Wage	Average wage of employees adjusted for inflation.	China City Yearbook & National Bureau of Statistics of China
City_envir	An indicator variable equal to one if the city is on the List of Key Cities for Environmental Protection according to the Eleventh Five-Year Plan for National Environmental Protection, and zero otherwise.	http://www.gov.cn/
Normal	An indicator variable equal to one if the city is an ordinary prefecture-level city, and zero if the city is sub-provincial or directly administered by the central government.	http://www.gov.cn/
SO_2_City	The natural logarithm of city-level GDP-adjusted industrial SO_2 emission (in tons).	China City Yearbook
CO_2_City	The natural logarithm of GDP-adjusted carbon emissions (in 10,000 tons). Sources of carbon emissions include electricity, gas and LPG, transportation, and thermal energy consumption.	China City Yearbook
NO_2_City	The average of daily NO_2 of city in a year.	CNRDS
Dust_City	The natural logarithm of GDP-adjusted industrial dust emission (in tons).	China City Yearbook
PM25_City	The average of PM2.5 of city in a year.	Atmospheric Composition Analysis Group
Sewage_City	The natural logarithm of GDP-adjusted industrial sewage discharge (in 10,000 tons).	China City Yearbook
EconPerf	The average of city GDP growth rate over the politician's tenure.	China City Yearbook & National Bureau of Statistics of China
EnvirPerf	The negative value of the mean logarithm of a city's industrial SO_2 emissions divided by the city's GDP during a politician's tenure.	China City Yearbook & National Bureau of Statistics of China
EnvirInv1	The amount of green spending of local government, scaled by GDP (inflation adjusted).	China City Yearbook
EnvirInv2	The amount of green spending of local government, scaled by population.	China City Yearbook
EnvirPunish	The natural logarithm of environmental violations enforced by the local city.	PKULaw Database
EnvirAttention	An indicator variable that equals one if the city ranks in the top quantile according to the percentage of environmental words in the government working report within the same province-year group, and zero otherwise.	Hand-collected

Panel B: Firm-Level Variables

Listed Company Level (As a Whole)		
SO_2_Firm	The amount of total SO_2 emissions (in tons) scaled by operating income (per 1,000,000 CNY), adjusted for inflation.	ESR & CNRDS & CSMAR
SO_2_Product	The amount of SO_2 produced (in tons) scaled by operating income (per 1,000,000 CNY), adjusted for inflation.	ESR & CNRDS & CSMAR
SO_2_Remove	The amount of SO_2 removed as a percentage of SO_2 produced.	ESR & CNRDS
Facility	The number of pollutant treatment facilities.	ESR & CNRDS
Capacity	The waste gas treatment capacity over total industrial output.	ESR & CNRDS
Size	The natural logarithm of total assets.	CSMAR
Lev	Total liabilities / total assets.	CSMAR
Growth	Growth rate in operating income.	CSMAR
ROA	Net income / total assets.	CSMAR
ROS	Return on sales.	CSMAR
RET	Annual stock return.	CSMAR
TQ	Tobin's Q.	CSMAR
TQ_industry	The median Tobin's Q of firm's industry.	CSMAR
FirmAge	The natural logarithm of years since firm's establishment.	CSMAR
Tangible	Tangible assets/total assets.	CSMAR
Competition	Herfindahl-Hirschman Index (HHI) based on a firm's prime operating revenue.	CSMAR
Foreign	The percentage of shares held by foreign shareholders.	CSMAR
Ana_attention	The natural logarithm of number of analysts following a firm in a year.	CSMAR
Big4	An indicator variable equals to one if the firm is audited by a Big Four accounting firm.	CSMAR
INS	The percentage of shares held by institutional investors.	CSMAR
Indeppct	The percentage of independent directors.	CSMAR
LocalSub_pct	A ratio of number of local subsidiaries over the total number of all subsidiaries for a firm.	CNRDS & CSMAR
SOE	An indicator variable equal to one if the firm is state-owned, and zero otherwise.	CSMAR
Pillar	An indicator variable of firm's economic importance, which equals one if the ratio of firm's operating income to city's GDP is higher than the sample median, and zero otherwise	CSMAR, China City Yearbook & National Bureau of Statistics of China
Violation_Local	An indicator variable equal to one if the firm's environmental violation is punished by local authorities, and zero otherwise.	Hand-collected
Violation_nonLocal	An indicator variable equal to one if the firm's environmental violation is punished by authorities of other cities or a central/provincial bureau, and zero otherwise.	Hand-collected
Detect_Local	An indicator variable equal to one if the firm's environmental violation is detected by local authorities, and zero otherwise.	Hand-collected
Detect_nonLocal	An indicator variable equal to one if the firm's environmental violation is detected by authorities of other cities or central/provincial bureau, and zero otherwise.	Hand-collected

Sub_Local1	Environment-related subsidies a firm receives from local government (municipal), divided by its total assets.	Annual report
Sub_Local2	Environment-related subsidies a firm receives from local government (municipal), divided by its operating income.	Annual report
Sub_Local3	The natural logarithm of the amount of environment-related subsidies a firm receives from local government (municipal).	Annual report
Sub_nonLocal	Environment-related subsidies a firm receives from other cities, divided by its total assets.	Annual report

Subsidiary Level		
SO_2_Sub	The amount of total SO_2 emission (in tons) scaled by the subsidiary's total industrial output (per 1000 CNY), adjusted for inflation.	ESR
SubSize	Industrial output adjusted for inflation.	ASIF
SubAge	The natural logarithm of years since subsidiary's establishment.	ASIF

Appendix B: Dictionary of Environment-Related Chinese Key Words and Their Corresponding Translations

Category	Subcategory	Key word (Chinese)	Key word (English)
Environment	Environment in general	环境	environment/environmental
		环保/环境保护	environment protection/ environmental conservation
		环境质量	environment quality
		环境治理/整治/防治	environment governance
		生态	ecology/ecological
		绿色/绿色转型	green/green transition
		蓝天	blue sky
		可持续发展	sustainable development
		环境责任保险/环责险	environmental liability insurance
	Energy & Natural resource	能源	energy
		能耗	energy consumption
		新能源	new energy
		清洁能源	clean energy
		太阳能/光伏/光电	solar energy/photovoltaic energy /PV
		风能/风力发电/风电	wind energy/wind power
		余热	cogeneration
		煤改气/油改气	coal to gas/oil to gas
		资源	resource
		海洋资源	marine/ocean
		土壤资源	soil
		森林资源/森林/林地	forest/forest land
		退耕还林	return farmland to forest
	Energy conservation	节约	save/preserve/ conserve/conservation
		节能	energy conservation/save energy
		降耗	reduce consumption
		节电/节约用电	save electricity
		节水/节约用水	save water
		节煤/减煤	save coal
	Emissions reduction	减排/低排/减污	reduce emissions/reduce pollution
		低碳/低氮	low carbon/low nitrogen
		脱硫	desulfurization
		脱硝	denitrification
	Recycling	回收	recycle
		再利用	reuse
		循环	circular
		再生	regeneration
		综合利用	comprehensive utilization
		以旧换新	trade-in

	Rehabilitation	恢复/修复/重建	rehabilitate/rehabilitation/ remediate/remediation/ restore/restoration
		清洁/清理/洁净/清扫/清除/淘汰	clean/remove/eliminate
		清淤	dredge
		吸污	suction
Pollution	Gas	空气污染/大气污染	air pollution
		废气/烟气/尾气/烟尘	waste gas/exhaust gas/flue gas/smoke
		一氧化碳/二氧化碳	CO/carbon monoxide/CO_2/carbon dioxide
		氮氧化物	NO_2/oxides of nitrogen/
		二氧化硫	sulfur dioxide
		挥发性有机化合物	VOCs
	Liquid	水污染	water pollution
		废水/废液/污水	waste water/polluted water/sewage
		废酸	waste acid
		酸雨	acid rain
		污泥	sludge/mud
	Solid	固体废物/固废	solid waste
		垃圾/废物/废弃物	rubbish
		废渣	waste residue
		危险废物/危废	hazardous waste
	Other	污染/污染物	pollution/pollutant
		排放/释放/排污	emit/emission
		锅炉	boiler
		烟囱	chimney
		黄标车	yellow label car
		噪音	noise
		在线监测系统	online monitoring system

Appendix C: City-Level Channels

Table C1: City-level channels

This table presents city-level evidence of EIP efforts in addressing environmental issues. *EnvirInv1* is the amount of green spending of a local government, scaled by its GDP with inflation adjusted. *EnvirInv2* is green spending of a local government, scaled by its population. *EnvirPunish* is the natural logarithm of environmental violations enforced by the local city. *EnvirAttention* is an indicator variable that equals one if the city ranks in the top quantile according to the percentage of environmental words in the government working report within the same province-year group, and zero otherwise. City- and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) EnvirInv1 (2003-2020)	(2) EnvirInv2 (2003-2020)	(3) EnvirPunish (2007-2020)	(4) EnvirAttention (2003-2020)
EIP	0.044**	0.082**	0.070*	0.048**
	(2.35)	(2.05)	(1.80)	(2.07)
N	4214	4214	3598	4612
Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Adjusted R^2	0.298	0.449	0.789	0.137

Figure 1: Ratio of EIPs by Year

Figure 1 presents the distribution of city leaders (mayors/CPC secretaries) with past environment work experience by year.

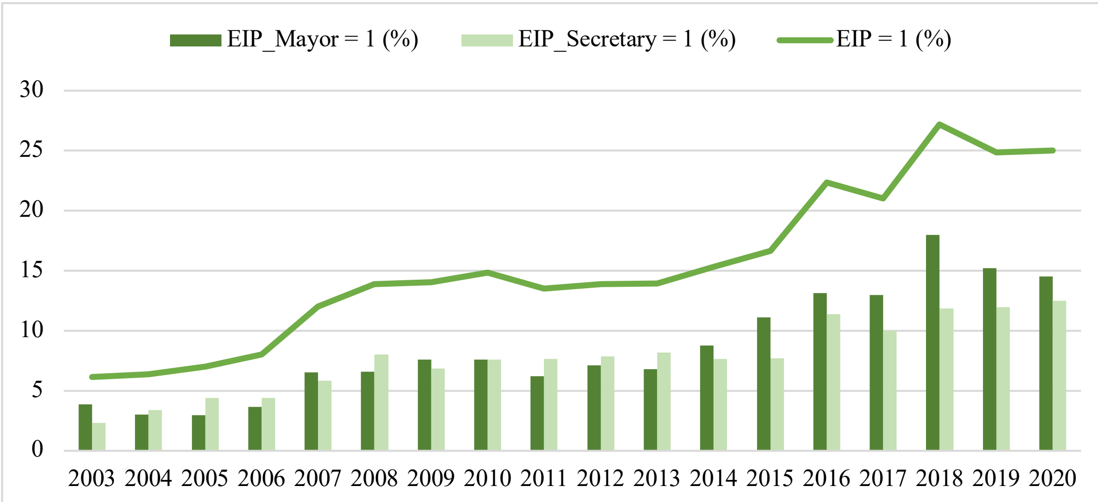

Table 1: Summary Statistics

This table presents the descriptive statistics of variables used in this study. Panel A corresponds to statistics at the firm-year level. Panel B corresponds to univariate comparisons between the EIP and non-EIP sample at the city-year, firm-year, and subsidiary-year level. The sample for firm-year and subsidiary-year level covers the period between 2003 and 2014 due to SO_2 data availability. The sample for city-year level covers the period between 2003 and 2020. See Appendix A for detailed definitions of the control variables.

Panel A: Summary statistics of the firm-year sample (2003–2014)

Variable	N	Mean	SD	p5	p25	p50	p75	p95
SO_2_Firm	5,721	0.465	1.452	0.000	0.005	0.040	0.250	1.985
EIP	5,721	0.116	0.320	0.000	0.000	0.000	0.000	1.000
Gdp	5,721	7.484	0.513	6.620	7.090	7.487	7.903	8.276
Population	5,721	2.357	0.558	1.573	1.893	2.308	2.749	3.362
Wage	5,721	4.600	0.191	4.254	4.478	4.611	4.735	4.904
Second ind	5,721	47.392	9.959	24.940	42.100	48.350	54.090	62.300
Age	5,721	4.021	0.154	3.850	3.951	4.007	4.078	4.205
Gender	5,721	0.033	0.178	0.000	0.000	0.000	0.000	0.000
Hometown	5,721	0.052	0.222	0.000	0.000	0.000	0.000	1.000
College	5,721	0.993	0.081	1.000	1.000	1.000	1.000	1.000
Edegree	5,721	0.119	0.324	0.000	0.000	0.000	0.000	1.000
Tenure	5,721	1.067	0.599	0.000	0.693	1.099	1.386	2.079
Size	5,721	22.116	1.326	20.279	21.156	21.921	22.872	24.632
FirmAge	5,721	0.972	0.291	0.301	0.845	1.041	1.176	1.301
Lev	5,721	0.513	0.186	0.181	0.386	0.522	0.649	0.800
ROA	5,721	0.035	0.054	-0.048	0.011	0.032	0.060	0.123
Tangible	5,721	0.948	0.054	0.839	0.934	0.964	0.982	0.999
Competition	5,721	0.110	0.104	0.019	0.047	0.077	0.131	0.309
SOE	5,721	0.640	0.480	0.000	0.000	1.000	1.000	1.000
Foreign	5,721	1.175	5.525	0.000	0.000	0.000	0.000	6.340

Panel B: Univariate comparisons between the EIP and non-EIP sample

Variable	EIP = 0	EIP = 1	diff (EIP = 0 – EIP = 1)	*p*-value
City-year Level (2003–2020)				
SO_2_City	4.496	4.261	0.235***	0.000
Gdp	6.989	7.028	–0.039**	0.036
Population	1.799	1.807	–0.008	0.610
Wage	4.466	4.505	–0.039*	0.068
Second_ind	47.685	44.341	3.344***	0.000
Age	3.995	3.975	0.020**	0.014
Gender	0.036	0.042	–0.006	0.433
Hometown	0.045	0.026	0.020**	0.020
College	0.983	0.997	–0.014***	0.007
Edegree	0.077	0.230	–0.153***	0.000
Tenure	0.985	0.903	0.081***	0.001
Mayor_Deputy	0.416	0.669	–0.253***	0.000
Firm-year Level (2003–2014)				
SO_2_Firm	0.489	0.282	0.207***	0.001
Size	22.116	22.116	–0.000	0.996
FirmAge	0.972	0.965	0.007	0.542
Lev	0.512	0.517	–0.004	0.573
ROA	0.035	0.038	–0.003	0.135
Tangible	0.948	0.947	0.001	0.708
Competition	0.110	0.109	0.001	0.796
SOE	0.653	0.545	0.107***	0.000
Foreign	1.257	0.552	0.705***	0.002
Subsidiary Level (2003–2014)				
SO_2_Sub	1.473	1.063	0.410***	0.000
SubSize	8.485	8.390	0.094***	0.000
SubAge	1.087	1.048	0.039***	0.000

Table 2: EIPs and Firm SO_2 Emissions (Baseline)

This table examines the relation between EIPs and local public firms' environmental performance. The dependent variable *SO_2_Firm* is the amount of total SO_2 emissions (in tons) scaled by operating income (per 1,000,000 CNY), adjusted for inflation. *EIP* is an indicator variable equal to one if the politician (mayor/CPC secretary) has previous environmental work experience, and zero otherwise. See Appendix A for detailed definitions of the control variables. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) SO_2_Firm	(2) SO_2_Firm	(3) SO_2_Firm
EIP	–0.245***	–0.219***	–0.252***
	(–3.29)	(–2.65)	(–3.51)
Gdp		–1.590**	–1.408*
		(–1.98)	(–1.69)
Population		0.046	–0.205
		(0.12)	(–0.64)
Wage		–0.795	–1.005
		(–0.96)	(–1.34)
Second_ind		–0.001	0.002
		(–0.14)	(0.30)
Age		–0.561	–0.720**
		(–1.51)	(–2.31)
Gender		0.034	0.049
		(0.50)	(0.76)
Hometown		0.026	0.091
		(0.29)	(1.24)
College		–0.255*	–0.174
		(–1.89)	(–1.63)
Edegree		0.028	0.069
		(0.35)	(1.04)
Tenure		–0.070*	–0.043
		(–1.88)	(–1.41)
Size		–0.363***	–0.341***
		(–3.19)	(–3.55)
FirmAge		0.292	0.201
		(1.20)	(0.73)
Lev		0.125	0.284
		(0.36)	(0.89)
ROA		–0.104	–0.214
		(–0.26)	(–0.66)
Tangible		0.909*	0.662
		(1.73)	(0.80)
Competition		0.769*	0.000
		(1.82)	(0.00)
SOE		–0.246	–0.194
		(–1.48)	(–1.22)
Foreign		–0.000	–0.001
		(–0.02)	(–0.19)
N	5967	5721	5577
Firm FE	Y	Y	Y
City FE	Y	Y	Y
Year FE	Y	Y	N
Industry-Year FE	N	N	Y
Adjusted R^2	0.461	0.476	0.576

Table 3: EIPs and Firm Abatement Efforts

This table examines the relation between EIPs and firm abatement efforts. *SO_2_Product* is the amount of SO_2 produced (in tons) scaled by operating income (per 1,000,000 CNY), adjusted for inflation. *SO_2_Remove* is the amount of SO_2 removed as a percentage of SO_2 produced. *Facility* is the number of pollutant treatment facilities. *Capacity* is the waste gas treatment capacity over total industrial output. Firm-level, city-level, and politician-level control variables are the same as those in Table 2. Column (3) is estimated with Poisson regression. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) SO_2_Product	(2) SO_2_Remove	(3) Facility	(4) Capacity
EIP	–0.235	0.033**	0.275**	0.027**
	(–1.34)	(1.99)	(2.04)	(2.10)
N	5721	5721	5511	3461
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Adjusted/Pseudo R^2	0.535	0.442	0.832	0.472

Table 4: PSM-DID Matching Analysis of EIP Turnover Events

This table provides dynamic evidence on the impact of EIPs on local public firms' environmental performance by conducting a PSM-DID analysis. Panel A reports summary statistics at the firm-year level for the subsample of firms that experienced EIP arriving events and for the control sample. The control sample is formed by matching each event firm to the non-event firm from the same city level (sub-provincial city or ordinary prefecture-level city) with the closest propensity score based on city characteristics including GDP, population, wage, and the secondary industry value-added as a percentage of GDP, as well as firm characteristics including SO_2 emissions level, firm size, leverage level, ROA, and firm age. The variable values are measured as of the year prior to the EIP turnover. For each variable, we report the mean, standard deviation, and the *t*-statistics for the differences in mean values between the treated and matched firms. Panel B presents estimation results. We include observations from three years prior to through three years post events for both the treated and the matched firms. The dependent variable SO_2_Firm is the natural logarithm of city-level GDP-adjusted industrial SO_2 emission (in tons). *Treat* is a dummy variable indicating whether the firm experienced an EIP turnover event, *Post* is a dummy variable equal to one if the treated firm (matched control firm) is within [0, 3] years after the turnover event year (the pseudo-event year). Firm-level, city-level, and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Comparisons of matching variables

	Treat Event (N = 99)		Pseudo Event (N = 99)		Difference	
	mean	sd	mean	sd	Treat – Pseudo	*p*-value
Gdp	7.298	0.415	7.392	0.397	–0.094	0.105
Population	2.115	0.382	2.151	0.355	–0.036	0.489
Wage	4.526	0.164	4.545	0.173	–0.019	0.434
Second_ind	49.954	6.791	51.085	7.686	–1.131	0.274
SO_2_Firm	0.043	1.984	0.012	0.052	0.032	0.171
Size	21.773	0.984	21.623	1.281	0.150	0.358
Lev	0.493	0.174	0.467	0.210	0.025	0.361
ROA	0.044	0.049	0.043	0.065	0.001	0.887
FirmAge	0.865	0.288	0.830	0.325	0.035	0.421

Panel B: PSM-DID estimation results

	(1) SO_2_Firm	(2) SO_2_Firm	(3) SO_2_Firm
Treat * Post	–0.376***	–0.363***	
	(–3.56)	(–3.46)	
Post	0.047		
	(1.14)		
Treat * I (T= –2)			–0.466
			(–1.41)
Treat * I (T= –1)			–0.518
			(–1.36)
Treat * I (T= 0)			–0.803**
			(–2.12)
Treat * I (T= 1)			–0.646*
			(–1.79)
Treat * I (T= 2)			–0.933***
			(–2.76)
Treat * I (T= 3)			–0.751**
			(–2.43)
N	583	583	583
Controls	Y	Y	Y
Firm FE	Y	Y	Y
City FE	Y	Y	Y
Year FE	Y	Y	Y
Window FE	N	Y	Y
Adjusted R^2	0.517	0.520	0.521

Table 5: Determinants of EIP Appointment

This table explores the determinants of EIP appointment. Panel A provides a comparison of city and politician characteristics between EIP and non-EIP cities for one year prior to city leader turnover. Panel B reports the results of multivariate analysis using logit and linear probability models. The dependent variable is an indicator of whether the city has at least one EIP leader in the current year (*EIP*). See Appendix A for detailed definitions of the control variables. All specifications include fixed effects as indicated in the table. The *t*-statistics reported in parentheses are based on standard errors clustered by city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Univariate analysis

Variable	EIP = 0	EIP = 1	diff (EIP = 1 – EIP = 0)	*p*-value
City-year Level				
Gdp	6.952	6.970	–0.018	0.633
Gdp_growth	0.114	0.102	–0.013*	0.051
Population	1.776	1.777	0.002	0.954
Wage	4.488	4.548	0.060***	0.001
Second_ind	48.385	46.132	–2.252**	0.021
SO_2_City	4.597	4.517	–0.080*	0.092
PM25_City	1.660	1.647	–0.014	0.263
City_envir	0.390	0.352	–0.037	0.396
Normal	0.949	0.930	–0.020	0.336
Age	3.976	3.964	–0.012	0.325
Gender	0.050	0.035	–0.014	0.457
Hometown	0.039	0.021	–0.018	0.294
College	0.994	1.000	0.006	0.359

Panel B: Multivariate analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	2003–2020		Before 2013		Post 2013	
	Logit	LPM	Logit	LPM	Logit	LPM
Gdp	–0.799	–0.169	–1.210	–0.249	–0.230	–0.263
	(–1.28)	(–0.56)	(–1.40)	(–0.83)	(–0.29)	(–0.40)
Gdp_growth	1.359	0.172	1.647	–0.244	2.946	0.132
	(0.75)	(0.80)	(0.63)	(–0.84)	(1.01)	(0.24)
Population	0.567	–0.221	0.515	0.024	0.549	0.261
	(0.88)	(–1.08)	(0.63)	(0.12)	(0.65)	(0.48)
Wage	1.961	0.507	3.259	0.201	–0.277	–0.293
	(1.07)	(1.45)	(1.52)	(0.42)	(–0.10)	(–0.44)
Second_ind	–0.020	0.000	–0.025	–0.000	–0.016	–0.005
	(–1.35)	(0.09)	(–1.35)	(–0.05)	(–0.85)	(–0.48)
SO_2_City	0.044	0.026	–0.170	0.065	0.579	0.121
	(0.16)	(0.41)	(–0.48)	(0.81)	(1.34)	(0.73)
PM25_City	0.208	–0.478	–1.350	–0.868*	1.345	0.298
	(0.19)	(–1.29)	(–0.99)	(–1.71)	(0.93)	(0.48)
City_envir	–0.288		–0.050		–0.466	
	(–0.99)		(–0.13)		(–1.17)	
Normal	–0.297		–0.509		–0.388	
	(–0.47)		(–0.57)		(–0.48)	
N	1001	999	583	526	418	327
Year FE	Y	Y	Y	Y	Y	Y
City FE	N	Y	N	Y	N	Y
Pseudo / Adjusted R^2	0.049	0.216	0.074	0.301	0.041	0.336

Table 6: Cross-Sectional Variations

This table examines the cross-sectional heterogeneity in the effect of EIP on firm emissions. The dependent variable *SO_2_Firm* is the amount of total SO_2 emissions (in tons) scaled by operating income (per 1,000,000 CNY), adjusted for inflation. *SecondTerm* is an indicator variable equal to one if the leader has been in the position for more than five years (following Li and Zhou (2005)). *Pillar* is an indicator variable of firm's economic importance, which equals one if the ratio of firm's operating income to the city's GDP is higher than the sample median. Firm-, city- and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) SO_2_Firm	(2) SO_2_Firm
EIP	–0.248***	–0.412***
	(–2.92)	(–3.31)
SecondTerm	0.011	
	(0.18)	
EIP * SecondTerm	0.296**	
	(2.36)	
Pillar		–0.383***
		(–2.86)
EIP * Pillar		0.350**
		(2.03)
N	5721	5721
Controls	Y	Y
Firm FE	Y	Y
City FE	Y	Y
Year FE	Y	Y
Adjusted R^2	0.476	0.479

Table 7: Mechanisms

This table explores several mechanisms through which we observe the negative relation between having an EIP and local firms' emissions levels. Panel A reports bivariate probit model estimation results of corporate environment fraud. *Detect_Local* is an indicator for whether the local firm is sanctioned by local environmental authorities, *Detect_nonLocal* is an indicator for whether the local firm is sanctioned by non-local environmental authorities. *Violation_Local* and *Violation_nonLocal*, are similarly defined. Variables explaining a firm's likelihood of committing fraud and being detected are defined in detail in Section 4.4.1. Robust standard errors, clustered at the firm level, are reported in parentheses. Panel B reports the results of green subsidies that firms receive from the government. Dependent variables are environment-related subsidies a firm receives from the local government (municipal) scaled by its total assets (*Sub_Local1*), environment-related subsidies a firm receives from the local government (municipal) scaled by its operating income (*Sub_Local2*), the natural logarithm of the total amount of green subsidies received from the local government (*Sub_Local3*), and green subsidies a firm receives from other cities divided by its total assets (*Sub_nonLocal*). Other firm-, city- and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city if not further illustrated. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Corporate environment fraud (2003–2018)

	(1) Violation_Local	(2) Detect_Local	(3) Violation_non Local	(4) Detect_non Local
EIP	–0.426***	0.188**	–0.229***	–0.101
	(–5.14)	(1.96)	(–3.38)	(–1.60)
N	24171		24171	
Controls	Y		Y	
Year FE	Y		Y	
L-likelihood	–1422.502		–2321.128	

Panel B: Green subsidies (2007–2020)

	(1) Sub_Local1	(2) Sub_Local2	(3) Sub_Local3	(4) Sub_nonLocal
EIP	0.074***	0.151***	0.442***	–0.006
	(3.13)	(2.87)	(4.11)	(–0.97)
N	31810	31782	31810	31810
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Adjusted R^2	0.185	0.180	0.250	0.179

Table 8: Spillover Effects on Non-Local Subsidiaries (2003–2014)

This table presents the effect of EIPs on non-local subsidiaries of local public firms. In Columns (1) - (3), we explore the effects of EIPs for all subsidiaries, local subsidiaries, and non-local subsidiaries, respectively. The dependent variable is the establishment-level SO_2 emission, which is defined as the amount of total SO_2 emissions (in tons) scaled by the subsidiary's total industrial output (per 1000 CNY), adjusted for inflation. Firm-level, city-level, and politician-level control variables are the same as those in Table 2. Extra control variables include the ratio of the number of local subsidiaries over the total number of all subsidiaries for a firm (*LocalSub_pct*), subsidiary size (*SubSize*), and age (*SubAge*). Firm-level, city-level, and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by subsidiary and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) All	(2) Local	(3) Non-local
EIP	–0.539***	–0.732**	–0.476**
	(–3.22)	(–2.03)	(–2.50)
LocalSub_pct	0.022	0.165	–0.156
	(0.08)	(0.45)	(–0.44)
SubSize	–2.521***	–2.003***	–2.877***
	(–10.11)	(–3.42)	(–11.12)
SubAge	0.253***	0.202	0.283**
	(2.75)	(1.25)	(2.40)
N	15142	4093	10109
Other Controls	Y	Y	Y
Firm FE	Y	Y	Y
Subsidiary FE	Y	Y	Y
City FE	Y	Y	Y
SubCity FE	Y	N	Y
Year FE	Y	Y	Y
Adjusted R^2	0.634	0.577	0.634

Table 9: Strategies of Site Selection for New Polluting Subsidiaries (2003–2020)

This table explores firms' strategies of site selection for new polluting subsidiaries in response to local EIPs. Dependent variables for Columns (1) - (4) are four indicator variables for whether firms set up new polluting subsidiaries in the parent firm's city (local), in other cities (non-local), in other cities with no EIP (non-local and non-EIP), and other cities with an EIP (non-local and EIP). Classification of polluting subsidiaries are described in Section 4.5.2. Firm-level, city-level, and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by firm and city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Local city	(2) Non-local city	(3) Non-local and non-EIP city	(4) Non-local and EIP city
EIP	–0.002*	0.004*	0.005**	0.001
	(–1.73)	(1.91)	(2.52)	(1.43)
N	13640	13640	13640	13640
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Adjusted R^2	0.089	0.102	0.178	0.216

Table 10: City-Level Analysis

This table presents the impact of EIPs on city-level environmental and economic performance. In Panel A, due to data availability, dependent variables are the natural logarithm of GDP-adjusted pollution measures with different sample periods. In Panel B, dependent variables are the growth rate of GDP (*Gdp_growth*) and GDP per capita (*PCGdp_growth*). City- and politician-level control variables are the same as those in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by city. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: EIP and city pollutant emissions

	(1)	(2)	(3)	(4)	(5)	(6)
	SO_2_City (2003-2020)	CO_2_City (2006-2019)	Dust_City (2011-2019)	PM25_City (2003-2020)	NO_2_City (2013-2020)	Sewage_City (2003-2020)
EIP	–0.047***	–0.020**	0.013	0.002	–0.032***	–0.018*
	(–2.64)	(–2.15)	(0.56)	(0.62)	(–2.75)	(–1.97)
N	4513	3030	2069	4911	1681	4674
Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y
Adjusted R^2	0.879	0.888	0.848	0.937	0.777	0.866

Panel B: EIP and city economic outcomes (2003–2020)

	(1)	(2)	(3)	(4)
	Gdp_growth	Gdp_growth	PCGdp_growth	PCGdp_growth
EIP	0.002	0.002	–0.002	0.001
	(0.48)	(0.40)	(–0.35)	(0.20)
EIP * Post2013		–0.001		–0.005
		(–0.10)		(–0.70)
N	4463	4463	4411	4411
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.468	0.468	0.231	0.231

Table 11: Politician Promotion Determinants Analysis (2003–2020)

This table reports the results of factors affecting a politician's likelihood of promotion and whether that differs for EIPs and non-EIPs. The dependent variable is an indicator of politician promotion defined following Wang, Zhang, and Zhou (2020). Economic performance (*EconPerf*) is measured as the average of city GDP growth rate over the politician's tenure. Environmental performance (*EnvirPerf*) is the negative value of the mean logarithm of a city's industrial SO_2 emission divided by the city's GDP during a politician's tenure. Therefore, greater values of performance measures represent better performance. City-level and politician-level control variables are the same as in Table 2. All specifications include fixed effects as indicated in the table. The *t*-statistics, in parentheses, are based on standard errors clustered by politician. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Full	(2) Full	(3) Full	(4) Before 2013	(5) Post 2013	(6) Full	(7) Before 2013	(8) Post 2013
EIP	0.046	0.367***	0.295**	0.015	0.714***	0.389**	–0.084	0.691***
	(1.64)	(2.63)	(2.05)	(0.05)	(3.09)	(2.55)	(–0.26)	(3.00)
ECIP						0.000	–0.068	–0.119
						(0.00)	(–0.47)	(–0.96)
EconPerf	–0.040		–0.008	0.076	0.161	0.063	–0.087	0.170
	(–0.46)		(–0.08)	(0.60)	(0.81)	(0.61)	(–0.63)	(0.82)
EnvirPerf		–0.002	–0.004	–0.050	–0.070	0.000	–0.055	–0.059
		(–0.08)	(–0.19)	(–1.16)	(–1.59)	(0.01)	(–1.20)	(–1.26)
EIP * EconPerf	–0.095		0.106	1.456***	–0.249	0.151	1.511***	–0.199
	(–0.41)		(0.42)	(2.98)	(–0.51)	(0.60)	(2.95)	(–0.41)
EIP * EnvirPerf		0.079**	0.065*	0.045	0.169***	0.086**	0.027	0.163***
		(2.49)	(1.92)	(0.67)	(3.01)	(2.42)	(0.39)	(2.93)
ECIP * EconPerf						–0.127	0.443**	–0.070
						(–0.90)	(2.03)	(–0.25)
ECIP * EnvirPerf						–0.006	–0.001	–0.042
						(–0.29)	(–0.02)	(–1.43)
N	8619	8063	7765	4669	3131	7854	4723	3131
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Position FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.107	0.113	0.122	0.127	0.138	0.114	0.118	0.141