

# Non-Governmental Monitoring of Local Governments Increases Compliance with Central Mandates: A National-Scale Field Experiment in China

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## Abstract

Central governments face compliance problems when they rely on local governments to implement policy. In authoritarian political systems, these challenges are pronounced because local governments do not face citizens at the polls. In a national-scale, randomized field experiment in China, we test whether a public, non-governmental rating of municipal governments' compliance with central mandates to disclose information about the management of pollution increased compliance. We find significant and positive treatment effects on compliance after only one year that persists with reinforcement into a second post-treatment year. The public rating appears to decrease the costs of monitoring compliance for the central government without increasing public and media attention to pollution, highlighting when this mode of governance is likely to emerge. These results reveal important roles that non-state actors can play in enhancing the accountability of local governments in authoritarian political systems.

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# 1 Introduction

In almost all countries, at least some policies governing areas from education to the environment are formulated centrally and then implemented by local governments. The compliance problems that arise from centralized policy-making and decentralized implementation are core impediments to good governance worldwide (Malesky, Nguyen and Tran, 2014). In democratic systems, the problems associated with the decentralized implementation of policies are often lessened by non-governmental organizations (NGOs) and the media, which are able to serve as information brokers about the noncompliance of local governments to both citizens and higher levels of government (Clark, 1995; Devas and Grant, 2003).

In authoritarian settings, local press outlets and non-state actors are often not available or able to challenge local officials about their implementation of policies and directives. Authoritarian governments often exclude non-state actors from governance or co-opt them to prevent collective organizing that could undermine regime stability (Foster, 2001; Heurlin, 2010; Jing, 2015). In China, for example, the national government has created rules that make it illegal for groups to openly pressure officials for changes to policy (Teets, 2017). Where non-state actors do participate, they gain influence mainly by cooperating with governments to produce social goods of mutual interest, rather than by challenging the positions and actions of governments (Ho, 2001; Spires, 2011; Teets, 2013; Zhan, Lo and Tang, 2013).

However, when it strengthens their regulatory capacity, it may be advantageous for central or provincial governments to allow NGOs to monitor and disclose information about the performance of local governments below them. A simple principal-agent model discussed in more detail below shows that noncompliance by local governments should be increasing in the monitoring costs of higher-level governments and decreasing in the threat of public discontent, both of which may be affected by NGO monitoring and disclosure. Similar theoretical arguments have been put forth regarding the press (Egorov, Guriev and Sonin, 2009; Lorentzen, Landry and Yasuda, 2013), but it is not clear that these arguments will hold for NGOs because the public discontent they generate in the process of decreasing monitoring costs may produce collective action that is problematic for the central government.

We designed a national-scale field experiment to test whether NGO monitoring of lo-

cal governments and the public disclosure of ratings based on this monitoring reduces the noncompliance of local governments with national mandates. We study this problem in the context of policies about pollution in China, where poor implementation of central policies by local governments results in severe loss of human well-being at globally unprecedented levels (Economy, 2011; Zhang and Cao, 2015). Despite environmental issues being a central focus of national policy-making, local governments have often failed to comply with environmental regulations and mandates from the center (Beyer, 2006; Zhang and Cao, 2015). Working with a leading environmental NGO in China, we study the public disclosure of monitoring about whether municipal governments comply with central mandates and release information to the public about the regulation of pollution. We observe the noncompliance of local governments over three years – one pre-treatment year and two post-treatment years – both for treated municipalities that are aware of monitoring and face the public disclosure of the resulting ratings and for control municipalities that do not know they are being monitored and do not face the public disclosure of ratings.

To preview the findings, the NGO’s public disclosure of monitoring significantly reduced noncompliance by municipal governments with central mandates to release information about the management of pollution. Both treated and control municipalities reduced noncompliance during the study period, likely in response to increasing central pressure. Treated municipalities exhibited even lower noncompliance than control cities after only one year and the treatment effect persisted with reinforcement into a second post-treatment year. These results highlight how non-state actors can promote accountability from local governments, which is an important step forward for research on civil society, authoritarian governance, and transparency in the public sector. Civil society groups can address non-compliance by local governments through information disclosure, especially when they can help higher levels of government more effectively apply administrative pressure by revealing information about compliance that is costly for the center to collect.

Using data on micro-blogging and citizen petitioning, as well as interviews with officials at 20 of the municipalities in the sample, we find little evidence of a public response to the monitoring and disclosure treatment. This may be one reason why this mode of governance has emerged for a variety of topics both inside China and elsewhere, as it does not seem to be

generating discontent that could lead to damaging collective action. Rather, the decrease in noncompliance is likely driven by decreased monitoring costs for higher levels of government. Our interviews with municipal officials, local scholars, and local NGOs that rate their own cities with PITI scores indicate that local officials are highly attuned to mandates handed down by higher levels of government, including those about the disclosure of information to the public.

This field experiment offers causal evidence that public disclosure of monitoring by NGOs changes the levels of compliance by local governments with central directives. Central governments both in China and in other authoritarian countries might come to depend on non-state actors to support broader political stability by challenging non-compliant actions of local governments. Methodologically, this is a major advance over observational studies that have used the NGO monitoring scores as a source of data rather than an intervention (Tan, 2014; Lorentzen, Landry and Yasuda, 2013) and a more recent study that has investigated the environmental impacts of the NGO monitoring using matching methods (Li et al., 2017). More broadly, the units of treatment and analysis in this study are municipal governments, rather than individual bureaucrats or officials as in related experimental studies of governance in China (Chen, Pan and Xu, 2016). Our results thus have considerable realism at a scale of governance not typical in field experimental research. These results demonstrate the potential for new modes of authoritarian governance, where NGOs solve information problems involved with the decentralized implementation of policies. This mode of governance is emerging both inside China in areas extending beyond pollution (e.g., Hu, Bai and Sun, 2016) and in other authoritarian countries (e.g., Malesky and Le, 2018).

## 2 Theory

### 2.1 The Principal-Agent Problem in Authoritarian Governance

Central governments in authoritarian political systems must manage public discontent to ensure political stability through a mix of repression, the supply of private or clientelistic goods to key supporters, and the provision of public goods and services (Desai, Olofsgård

and Yousef, 2009). In many cases, the poor performance of local governments is a key impediment to providing public goods and services (Zhang and Cao, 2015). Local officials can accrue rents by colluding with organizations that have an interest in skirting central rules and by reducing effort to provide public goods mandated by the center. Less nefariously, local officials may choose to comply only with the mandates they believe to be a high priority for the central government because of limited resources (Mei and Pearson, 2014, 30). Because local officials depend on performance for promotion within a centralized cadre system in many authoritarian settings, they have incentives to focus on actions that higher level governments can observe effectively (Zhu, 2014; Xu, 2011).

As in other principal-agent problems, gathering information about the performance of local governments is key for oversight by central governments and the management of cadre systems. The need for information about local governments explains why many authoritarian regimes operate petitioning systems (Dimitrov, 2015), and allow uncompetitive elections (Gandhi and Lust-Okar, 2009), limited freedom of the press (Egorov, Guriev and Sonin, 2009), investigative reporting (Lorentzen, 2014), and limited protest (Lorentzen, 2013), while also requiring disclosure of information to the public (Lorentzen, Landry and Yasuda, 2013; Stromseth, Malesky and Gueorguiev, 2017).

Yet the information produced under these strategies must be balanced against its potential to facilitate collective action that undermines political stability (Chen and Xu, 2017). There is skepticism that non-state actors have good strategies to challenge governments and elicit accountability under these conditions because they are vehicles for collective action (Foster, 2001; Heurlin, 2010).

We argue that it can be in the interest of central governments to allow non-state actors to publicize the compliance of local governments with central mandates. As with the press (Lorentzen, 2014), the center has incentives to harness efforts by NGOs as long as they result in improved governance and do not undermine political stability. Indeed, since local officials can manipulate the self-reported information that is the basis for many official monitoring methods (Wallace, 2016; Ghanem and Zhang, 2014; Pan and Chen, 2018), it may be advantageous for the center to rely partially on independent sources of information for oversight and the management of cadre systems.

## 2.2 Local and Central Government Strategies

The monitoring and compliance challenges that come from decentralization can be characterized as a typical principal-agent problem. Here we briefly outline the way that a principal-agent model applies to a central government and local government to clarify the actors and the mechanisms by which NGOs might play a role in addressing noncompliance by local governments. The full model is in the SI Appendix [E](#).

Consider a local government that is under a mandate from the central government to comply with a rule or deliver a service. Each local government chooses whether to comply or not comply with the mandate in a binary decision  $N$ . The payoff of noncompliance for the local government is increasing in the implementation costs avoided and the rents available from noncompliance, which we parameterize as a scaling factor  $r$ . Absent monitoring and enforcement from the center (binary indicator,  $M$ ), local governments always prefer noncompliance. Local governments have varying levels of sensitivity to punishment (or the loss of benefits, such as promotion potential) from the central government, indicated by scaling factor  $\eta$ . The utility to local governments of noncompliance relative to compliance is thus:

$$U_L = rN - \eta MN \tag{1}$$

The central government chooses whether or not to monitor local governments in a binary decision  $M$ , which is subject to a scaling factor  $c$  that indicates the cost of monitoring. We assume that at cost  $c$ , monitoring will correctly detect the compliance status of the local government. The central government incurs a cost for noncompliance in terms of public discontent,  $\delta$ . If the center monitors, it will be able to recover some of its loss from any noncompliance through enforcement, given by a recovery parameter  $e$ . This implies the central government receives a positive net return to enforcement; if this condition is not met then it never makes sense for the central government to monitor. The central government thus has the following utility related to noncompliance and monitoring:

$$U_C = -\delta N - cM + e\delta NM \tag{2}$$

Just as local governments always choose noncompliance if the central government does

not monitor, the central government always chooses not to monitor if the local government chooses to comply since monitoring is costly. We assume that  $\eta > r$  (penalties exceed rents) and that  $e > c$  (recoveries exceed monitoring costs) to avoid the dominant strategies of noncompliance and no monitoring. These assumptions form important scope conditions on a principal-agent theory of NGO monitoring in authoritarian governance. They indicate that the costs to local officials of punishment for noncompliance, such as the loss of promotion potential, must be significant and that the center must be able to effectively wield such punishments to recoup value lost to noncompliance. These conditions may not hold in weaker authoritarian regimes. Given these assumptions, neither the local government sensitivity to punishment ( $\eta$ ) nor the magnitude of benefits available for noncompliance ( $r$ ) change the equilibrium level of noncompliance in this model, since they cause the center to change the probability of monitoring ( $q_M = r/\eta$ , see SI Appendix E, Eq. E7) to combat the severity of the temptation to not comply by local governments.

We solve for the mixed-strategy equilibrium where each player chooses probabilities over their actions. The equilibrium probability of noncompliance by local government ( $p_N$ ) is:

$$p_N = c/e\delta \tag{3}$$

This result contains the two predictions that animate the field experiment. The probability of noncompliance by the local government is increasing in monitoring costs ( $c$ ) and decreasing in the discontent caused by noncompliance ( $\delta$ ). Non-state actors that can affect these quantities have the opportunity to boost the compliance of local governments.

### 2.3 Empirical Implications

We predict that the public disclosure of monitoring about the performance of local governments by NGOs ( $D$ ) might decrease monitoring costs and increase public discontent such that the equilibrium level of noncompliance is decreased.

$$p_N = \frac{(c - c'D)}{e(\delta + \delta'D)} \tag{4}$$

In terms of monitoring costs ( $c'$ ), NGOs can be credible purveyors of information and



thus reduce monitoring costs by the center. Indeed, governments in a wide variety of settings shift the costs of monitoring onto other parties that are willing to pay them (McCubbins and Schwartz, 1984).

Although NGOs could also change the compliance costs for local government (i.e., decrease  $r$ ), for instance by making compliance easier by providing information about requirements, this is not a mechanism that would change the equilibrium level of noncompliance. In our model, the central government strategically adjusts monitoring effort in response to the costliness of compliance for the local government. Thus, even though NGOs could promote “positive learning opportunities” for local governments (Teets, 2014, 159), this would cause the central government to monitor less often in equilibrium, yielding no change in the equilibrium level of noncompliance.

In terms of discontent ( $\delta'$ ), NGOs that publicly disclose information that is critical of local governments without being punished may decrease uncertainty among citizens about their ability to speak up against noncompliance. The release of information about noncompliance also provides the public with the information needed for mass discussions about the performance of local governments, which may make the central government more sensitive to noncompliance. A recent audit experiment in China suggests local governments are more responsive to citizen concerns that might reach the central government (Chen, Pan and Xu, 2016). Additionally, to the extent that citizens pay attention to the ratings, the central government might fear losing legitimacy in the eyes of the public for not reacting to known noncompliance. While these are all possible effects, as we discuss in more detail below, NGOs that boost discontent are unlikely to have a sustainable strategy for engagement in authoritarian settings because of the risk of collective action they pose.

We expect the public release of monitoring by NGOs to decrease noncompliance by local governments. We designed a national-scale field experiment that varies whether municipal governments are subject to the public release of monitoring about their compliance with national mandates to make information available to the public about the management of pollution. We estimate whether noncompliance is affected by this treatment. The principal-agent theory we outline is not specific to the setting or topic that we investigate but points to the settings where NGOs are likely to be most effective in addressing noncompliance by

local governments in authoritarian political systems: settings with high monitoring costs and high levels of discontent caused by noncompliance. A null treatment effect could either mean (i) the scope conditions ( $\eta > r$ ) of the theory are not met; or (ii) the treatment does not cause a change to monitoring costs or public discontent.

### 3 Research Design

Together with the Institute for Public and Environmental Affairs (IPE), our research team monitored a new set of municipal governments for compliance with national mandates about the public release of information and randomized whether the monitoring was publicly disclosed. After disclosing the monitoring for the treatment cities, we observe noncompliance of the treatment and control cities over the next two years. Both kinds of cities face the same mandates for information disclosure and administrative pressures from the center, which allows us to understand how NGO monitoring enhances the administration of these mandates. We registered the design of this study and our plans for analysis prior to assigning treatment.

#### 3.1 Setting

China's development has been characterized by rapid economic growth, damaging levels of pollution, and some fiscal and political decentralization. The central government has prioritized environmental management at the highest levels of planning and requires local governments to improve environmental quality, recognizing that environmental degradation is a threat to social and political stability (Liu, Zhang and Bi, 2012). Starting with China's 11th Five Year Plan (2006-2010), the central government mobilized local governments via the application of the target responsibility system for energy conservation and pollution reduction, as it has done effectively in other areas (e.g., Zhu and Zhang, 2016). With this system, environmental targets began to be used in the evaluation of local leaders and environmental performance contributes to the promotion of local leaders (Zheng et al., 2014). In 2016, China constructed the Green Development Indicator System, a rating system for the performance of local governments that weights GDP growth less than half of resource utiliza-

tion and environmental quality, to further connect environmental performance to promotion incentives for local officials.

Despite the attention paid to environmental management at the national level, local governments have emerged as key impediments to the reduction of pollution (Beyer, 2006; Zhang and Cao, 2015). Shortcomings in China’s planning system and policy instruments (Wang, 2013), corruption of local officials (Ong, 2012), and insufficient capacities of local agencies (Zhan, Lo and Tang, 2013) combine to perpetuate the “implementation gap” in China’s environmental management (Kostka, 2014). Environmental targets are handed down as mandates from the center, but monitoring is difficult and limited, which creates significant implementation problems (Kostka, 2016). Additionally, the social and relational gains to local officials of helping firms skirt central rules on pollution control can be significant (Hills and Man, 1998). A lack of transparency about the environmental actions of local governments helps local officials to gain these private rents from noncompliance.

The central government has generally allowed NGOs to carry out a range of activities related to environmental management, potentially reflecting the central government’s recognition of its limited capacity to deal with adverse effects of development and its need for expertise and information (Mertha, 2009; Wong, 2005). Indeed, there has been a move to “consultative authoritarianism”, whereby central and local governments encourage the co-production of public goods by non-state actors in ways that enhance the capacities of the state while limiting NGOs’ ability to act for wider political change (Teets, 2013, 2014).

There is some evidence that the involvement of NGOs in the implementation of local programs can help the central government overcome principal-agent problems. For example, Teets (2009) highlights how NGO involvement in the 2009 Sichuan earthquake reconstruction process promoted accountability from local governments for the use of reconstruction funds, since the co-implementation of programs created a kind of mutual transparency between local governments and NGOs that helped the central government oversee both. This parallels the role of NGOs in other sectors, where the state fosters “institutional interdependence” with NGOs that allows the state to fulfill its functions more effectively (Hsu, 2010). In relation to pollution, the central Ministry of Environmental Protection requires local Environmental Protection Bureaus (EPBs) to facilitate the participation and supervision of environmental

protection by citizens and NGOs, potentially highlighting the emergence of a new form of governance.

More broadly, we have collected twelve examples of NGOs that are now pursuing a version of the monitoring and disclosure strategy that we study in different sectors across China, highlighting its growing relevance.<sup>1</sup> However, the potential of this kind of activity has not been extensively theorized or analyzed in past research on authoritarian governance.

### **3.2 Treatment: Rating Transparency about the Management of Pollution**

In the last decade, numerous rules and regulations have been adopted that intend to increase the public disclosure of information about the management of pollution in China. The original transparency mandates came into force on May 1, 2008 with the Regulations of the People’s Republic of China on Open Government Information and the Ministry of Environmental Protection Measures on Open Environmental Information (see also, [Stromseth, Malesky and Gueorguiev, 2017](#), Ch. 2). Since then, a flurry of environmental laws, regulations, and Ministry of Environmental Protection requirements related to information disclosure have passed.<sup>2</sup> These rules require all local governments to disclose a variety of information to the public, such as records of violations by firms, the number of petitions to the government regarding pollution, the disposition of these petitions, emissions data, and environmental impact assessments of major projects. These are relatively complex and multi-faceted mandates that touch on many areas of government activity, including the supervision of enterprises, the processing of information, the maintenance of information systems, and the tracking of major public projects. Because the pollution transparency mandates covers a number of activities, both monitoring and compliance are difficult.

Government-led rating schemes have been a regular tool of public administration in China for decades, but monitoring by NGOs resolves some of the problems of these schemes.

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<sup>1</sup>See SI Appendix J where we identify the organizations, the type of monitoring they undertake, and their information disclosure strategies.

<sup>2</sup>Important measures include Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure and Measures on Supervisory Monitoring and Information Disclosure for Key State-monitored Enterprises.

The traditional “target-responsibility” system in China’s public sector governance has used quantitative targets to hold local officials accountable for achieving mandates (Jing, Cui and Li, 2015). Yet these target systems suffer from opportunistic gaming by local officials. Obfuscation (Wallace, 2016) has brought about the need for top-down quality control procedures, demonstrating the difficulty of central government monitoring of local governments. Monitoring of compliance by NGOs removes the self-reporting problem from the targeting system, thereby offering the center a better opportunity to seek accountability on the basis of reliable data.

Our partner in this work, IPE, uses as its main strategy the publication of information about pollution and particularly the implementation of central government mandates about the disclosure of information about pollution. Its founder, Ma Jun (马军), began his career as an investigative reporter and has won international acclaim for publicizing the severity and impact of environmental problems in China. The work of IPE is not embedded in any state agency and IPE has been on the leading edge of monitoring and rating local governments for a number of years (Johnson, 2011). The Pollution Information Transparency Index (PITI), which is published annually by IPE, rates municipal governments across the country on their compliance with central mandates for the public disclosure of information about pollution. Later several local NGOs also used the method developed by IPE to evaluate non-key cities in Anhui, Shandong, and Fujian provinces, showing the potential of this approach to be used by other types of NGOs. The central government, and in particular the Ministry of Environmental Protection (MEP), has responded to the publication of PITI scores by publicly stating that it welcomes social organizations to actively participate in the promotion of environmental information disclosure.<sup>3</sup>

The PITI includes ratings of the online disclosure of environmental monitoring, disclosure of information from environmental impact assessments (EIAs), publication of violations by enterprises, and information about responsiveness to public information requests. These components of the ratings are weighted and aggregated to form a score that ranges from 0 to 100 (Table 1; see SI Appendix A for detailed scoring criteria). The rating process includes a number of quality controls for each category to avoid rewarding points for misinformation.

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<sup>3</sup>See: [http://news.ifeng.com/a/20170927/52185125\\_0.shtml](http://news.ifeng.com/a/20170927/52185125_0.shtml), Accessed 6 August 2018.

For example, a high score for transparency about enterprise violations is only assigned if specific firms, violation types, and dates are provided in disclosures by city governments. The score is calibrated such that a city that complies fully with the national government regulations would earn 60 points, while an additional 40 points can be earned by addressing the intent of the mandates to facilitate public access to information in convenient, timely, user-friendly, well-organized and understandable ways, addressing obfuscation that can creep into literal compliance.

**Table 1:** Components of PITI Score

Category	Item	Weight
Supervision Records	Records of Enterprise Violations	23 pts
	Enterprise Environmental Behavior	5 pts
	Discharge Fee Data	2 pts
	Automatic Monitoring of Pollution Sources	20 pts
Responsiveness	Verified Petitions and Complaints	7 pts
	Response to Public Information Requests	8 pts
Enterprise Emission Data	Key Enterprise Emission Data	16 pts
	Clean Product Audit Information	4 pts
EIA Information	Environmental Impact Assessment Information	15 pts

For each city in the treatment and control groups, our research team constructed a PITI score. We replicated the PITI scoring process using data from 2014 (pre-treatment) and 2015/2016 (two post-treatment years), with cross-checking from IPE prior to public dissemination (see SI Appendix A).

The treatment is the disclosure of the PITI score by IPE and the reinforced dissemination by our research team. The PITI scores for cities in the treatment group were published in a variety of ways, including as part of IPE’s annual PITI release, online (via WeChat and Weibo, popular Chinese micro-blog services), and direct mailings of reports to local environmental protection bureaus assigned to treatment (see SI Appendix A for details). The release of the PITI score report generates national attention among policymakers, the media, non-governmental organizations, and citizens. The PITI scores for cities in the control group were not released publicly or revealed to the cities.

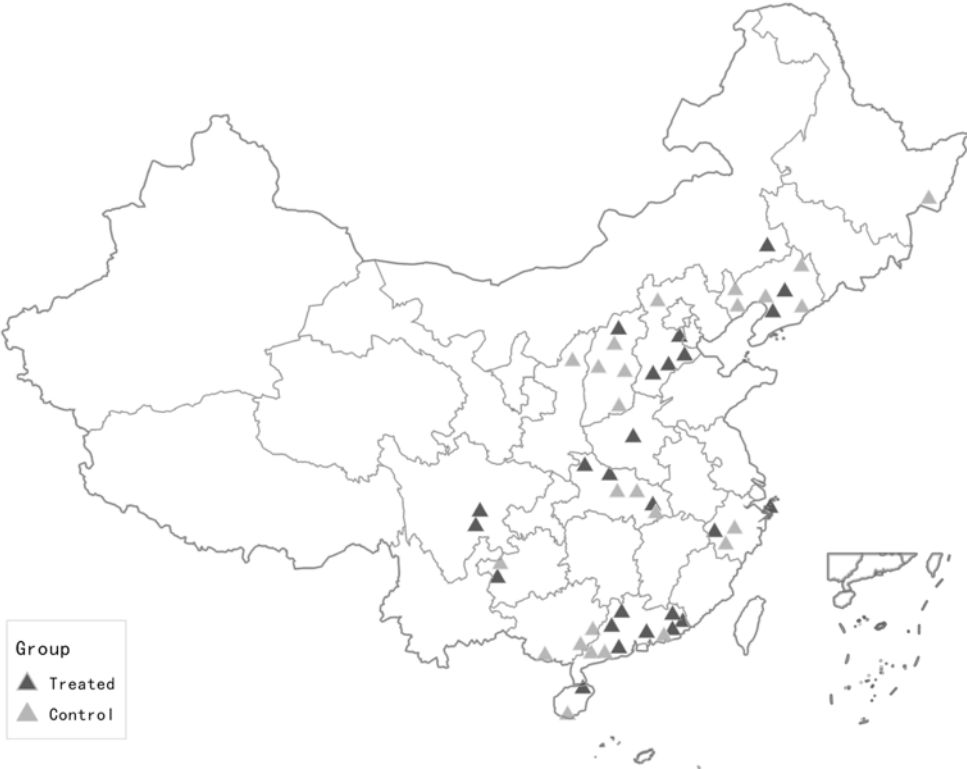
### 3.3 Sample and Assignment

It was impossible for us to draw a representative sample of Chinese cities for this study owing to the prior inclusion of 148 cities in the PITI by IPE or local NGOs. The cities already evaluated by IPE in prior years were Environmental Protection Key Cities selected by the Ministry of Environmental Protection, representing provincial capital cities, cities in special economic zones, coastal open cities, and major tourist cities. These cities are likely to be the cities where NGO disclosure of monitoring might be most effective, owing to their prominence. We chose to draw a purposeful sample of cities not previously monitored where we expected the treatment to have the greatest potential. Local NGOs rated additional cities based on their interest and availability (see SI Appendix I for interviews with these local NGOs). Given the skepticism about the role NGOs can play in authoritarian regimes, we considered it preferable to explore the potential of a program like PITI to improve compliance by municipal governments with central mandates, rather than to pursue an underpowered experiment in a heterogeneous sample with many cities that, according to past theoretical and empirical work (Lorentzen, Landry and Yasuda, 2013), would be less likely to respond to treatment. Because China is a “hard case” for such an effect to emerge, estimating an upper bound on the effects of NGO monitoring and ratings on the actions of local governments is useful and can be followed by further explorations of the limits of monitoring and rating by NGOs.

From the cities not included in prior PITI monitoring and releases, we selected the 50 cities with the highest predicted PITI scores based on out-of-sample predictions from the empirical model of PITI scores in Lorentzen, Landry and Yasuda (2013), which analyzed cities already rated for several years in PITI. We selected the sample before collecting any data for the pre-treatment PITI evaluation. In particular, we used their minimally specified model reported in Table 1 labeled “Primary Controls,” minus the control variables dealing with pollution levels, to predict out-of-sample the cities that would have the highest PITI scores after being part of the program for several years. If the theory presented by Lorentzen, Landry and Yasuda (2013) is correct, the sample we select should be less resistant to improving compliance with mandates about information disclosure, thus meeting our ana-

lytical goal of characterizing the potential of NGO monitoring for addressing noncompliance. Specifically, [Lorentzen, Landry and Yasuda \(2013\)](#) show that low large firm dominance, high levels of budget revenue, and less dependence on central transfers are associated with greater compliance with transparency mandates following several years of PITI ratings.

We randomly assigned 25 of the 50 sampled municipalities to a public disclosure of their PITI score, forming matched-pair blocks based on an ordering of the pre-treatment PITI scores for assignment. As [Figure 1](#) shows, the cities were well-distributed across both coastal and inland provinces. Most of the cities in our sample are secondary, mid-sized cities with generally lower levels of income than internationally-known coastal cities, which were included in previous PITI ratings. Balance statistics and test for all pre-treatment outcome measures can be found in [Tables C1-3](#) in the [SI Appendix C](#).



**Figure 1:** Assignment of treatment and control among experimental sample of cities



### 3.4 Measurement

**Measuring Compliance.** The disclosure of PITI scores is the treatment, while the PITI scores themselves measure compliance with central mandates for transparency about pollution and its regulation. As pre-registered, we use the change in the overall PITI score and its component parts from the pre-treatment baseline to each of two post-treatment years as the main outcome variable (see SI Appendix A for a detailed description of the scores). The component parts of the PITI score provide insights into the areas of transparency by city governments that change over time. Increases in the overall and component PITI scores represent increases in compliance with central mandates, which are required of both treatment and control cities. Increases in PITI scores of treatment cities above control cities represent increases in compliance with central mandates due to the disclosure of PITI scores.

**Measuring Public Discontent with Public and Media Attention.** If the mechanism involving public discontent is operative, we would expect to observe greater public and media attention to transparency and pollution in treated cities. In order to probe the plausibility of this mechanism, we measure attention by the public and media to pollution and transparency. One drawback of this measure is that a quick local government response to the threat of public discontent might preempt the manifestation of that discontent in public micro-blogs and media news reports.

Micro-blogging is one of the most prominent ways that Chinese citizens and NGOs engage with public policy issues, including the management of pollution (van Rooij, 2010; Yang and Calhoun, 2007).<sup>4</sup> Specifically, we search the Weibo micro-blogging platform for five pollution keywords (污染 (Pollution); PM10; PM2.5; 雾霾 (Smog); 灰霾 (Haze)) and four transparency keywords (PITI; 信息公开 (Public Information Disclosure); 透明度 (Transparency); 披露 (Disclosure)) and sum the number of posts among users registered in each sampled city for the baseline pre-treatment year and the two post-treatment years.

We also collect data on the number and content of citizen petitions as an alternative

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<sup>4</sup>Although the Chinese government is widely known to censor micro-blogs (King, Pan and Roberts, 2014), we expect little censoring of micro-blogging about PITI or the management of pollution because it is sanctioned by the central government. Moreover, any automated censoring will have a similar effect on micro-blogging in treated and control cities.

measure of public attention and discontent. According to China’s environmental regulations, citizens and organizations have the right to make reports of perceived illegal pollution, fumes, odors, or noise to local EPBs through e-mail, telephone, fax, letter or in-person visits. These petitions are common in China (Luehrmann, 2003; Meligrana, Li and Zhang, 2011). The information that is made available in PITI scores is likely to lower the costs of petitioning. And the PITI index makes known that responding to citizen petitions is one of the main responsibilities of municipal governments and legitimizes scrutiny of local governments. The number and channels of citizen petitions by city is obtained from the Environmental Statistics Database.

Finally, we collect data on media attention to transparency and pollution. In China, the traditional media plays an important role in reporting on environmental issues, likely because environmental management has been elevated to the highest levels of official attention and is regularly discussed by top officials in public settings (Ma, Webber and Finlayson, 2009). Baidu News is the largest Chinese news search platform, releasing a number of news article every day and indexing news stories from more than 500 authoritative websites. To measure attention to pollution in the news media, we search headlines and full-text articles in the Baidu News for the same keywords and each city name as described above for the Weibo data, summing the number of returned news articles by city for the baseline pre-treatment year and the two post-treatment years.<sup>5</sup>

### 3.5 Hypothesis Testing

Following our registered pre-analysis plan, we test whether observed treatment effects are inconsistent with the sharp null hypothesis using randomization inference. For each outcome presented below, the observed average treatment effect in the sample for each measure is a difference-in-differences measure (Eq. 5), which adjusts for any remaining imbalances in the pre-treatment outcomes following randomization:

$$\text{ATE} = \frac{\sum_{i:d_i=1} Y_{i,t=x}(1) - Y_{i,t=0}(1)}{N_{i:d_i=1}} - \frac{\sum_{i:d_i=0} Y_{i,t=x}(0) - Y_{i,t=0}(0)}{N_{i:d_i=0}} \quad (5)$$

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<sup>5</sup>We compile all Weibo and Baidu data in 2017 after the Year 2 post-treatment period so that the results are interpretable over time.

We use randomization inference to test whether our observed average treatment effects for different outcomes are inconsistent with a sharp null hypothesis of no effect for any unit. Assuming the sharp null, we exactly replicate our random assignment process including blocking to generate a randomization distribution of the test statistic, which characterizes the design-based uncertainty introduced by permissible random draws in our study. We compare our observed average treatment effects to this randomization distribution to compute  $p$ -values. Also as pre-registered, we estimate heterogeneous effects by pre-treatment PITI score and pre-treatment measures of city-level citizen petitioning related to the environment using multiplicative interaction in an OLS model (see SI Appendix D).

## 4 Results

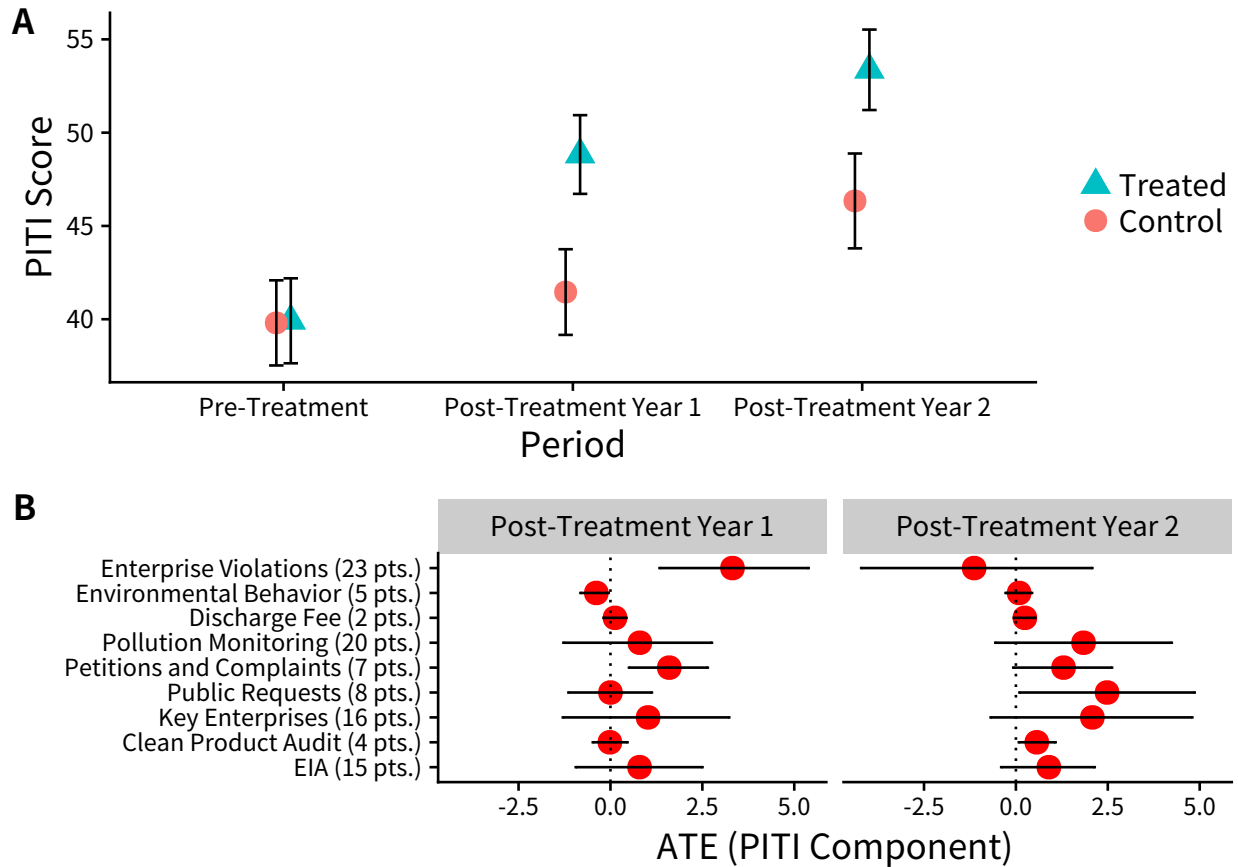
### 4.1 Main Results

The treatment – public disclosure of PITI scores – increases compliance of city governments with mandates to be transparent about the management of pollution. On average, cities in the treatment group have transparency scores that are approximately 7 points higher on a scale of 0 to 100 than the control cities. Figure 2 shows the effect of treatment on both the aggregate and component PITI scores for both post-treatment year 1 and post-treatment year 2 (see SI Appendix C for results in tabular format). Per our blocking strategy, the mean PITI score of the treatment and control groups are almost equal before treatment. One year following treatment, PITI scores increased in both the treatment group (from 39.9 to 48.8) and control group (from 39.8 to 41.5) likely due to the increasing stringency of disclosure requirements by China’s central government.<sup>6</sup> Most importantly, the gap between the treatment group and control group is 7.3 points on the 0-100 transparency score range ( $p < 0.01$ ), which indicates a large increase in transparency levels for the treatment group above the background increase in the control group. Two years following treatment, PITI scores continued increasing in both the treatment group (from 39.9 to 53.4) and control group (from 39.8 to 46.3), and the gap between the treatment group and control group is

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<sup>6</sup>See SI Appendix G where local officials noted increasing mandates, for example saying, “it is becoming stricter year by year.”

6.9 points on the 0-100 transparency score range ( $p = 0.06$ ). Of the total 13.5 point increase in the PITI score in the treatment group over the two years of monitoring, 6.5 points can be attributed to administrative pressures from the center that affects both the treatment and control groups; the remaining 7 point increase can be attributed to the disclosure of PITI scores.



**Figure 2:** Treatment effect on PITI aggregate and component scores. *Notes:* Panel A shows the average aggregate scores by experimental condition in each year of the study, with standard errors derived from bootstrap sampling within experimental conditions; Panel B shows observed differences-in-differences from baseline between the experimental conditions, with 90% confidence intervals derived from block-wise bootstrap sampling.

A variety of PITI components account for the aggregate treatment effect in the two post-treatment years. In post-treatment year 1, two items stand out as particularly important. First, treated cities increase the disclosure of information about enterprise violations of pollution standards as compared to control cities. The information provided to the public on enterprise violations, which comprises 23 out of the possible 100 points of the PITI score, is likely to be helpful for decreasing the costs of monitoring compliance with mandates to

disclose information, since the many enterprises offer significant scope for obfuscation by local governments. Second, treated municipalities increase transparency about the disposition of citizen petitions and complaints, which are a common means by which citizens make local governments aware of environmental violations. A quick increase in transparency regarding the disposition of petitions may be a way for cities to head off public discontent caused by the PITI treatment. In post-treatment year 2, transparency regarding petitions and complaints remains one of the components with a treatment effect that is inconsistent with the null hypothesis. Treated cities also significantly increase transparency regarding public requests and clean product audits as compared to control cities in post-treatment year 2. Surprisingly, control cities surpassed treatment cities in transparency about enterprise violations on average in post-treatment year 2. This may be due to spillovers, which we explore in more detail below (see also SI Appendix F). It may also be due to ceiling effects, as treated cities in our sample performed better on transparency regarding enterprise violations (mean=11.5 points) than the Key Cities already rated by IPE (mean=10.7) after only one year. By post-treatment year 2, both the treatment cities (mean=13.4) and control cities (mean=14.3) displayed greater transparency than Key Cities already rated by IPE (mean=11.2).

Although the average PITI score increased 7.3 points more in the treatment group than the control group, transparency practices by city governments in both conditions still have significant scope for improvement. Both the treatment cities and control cities scored approximately half of the total possible points after two years on average. This suggests that compliance with mandates to release information to the public may be a difficult task for cities and that the payoffs of noncompliance may be significant. Following our model, it also indicates that either monitoring of compliance is difficult for central and provincial governments or that the threat of public discontent due to noncompliance is presently low. While the central government can go through the websites of city governments to monitor compliance on individual items, the wide scope of the required disclosures of various types of information likely makes monitoring compliance difficult. In fact, our research team took approximately one person-week to collect and process data into a PITI score for each city. Our results suggests that the disclosure of monitoring by NGOs will be most effective as applied to complex and multi-faceted mandates.

## 4.2 Spillover

Information being monitored by PITI may travel between municipal governments, especially within the same province, since China’s political system is hierarchical with municipal governments nested within provincial governments. Observing a counterpart city being rated might induce untreated cities to expand their own efforts to comply with transparency requirements, because of rational expectations that they will be subject to monitoring in the near future and updating among municipal officials about the cost of monitoring for NGOs. Alternatively, provincial governments that are alerted to the compliance behavior of some cities under their jurisdiction may uniformly increase effort to ensure compliance by all cities, themselves facing greater scrutiny from the center about their effectiveness in overseeing municipal governments. Indeed, when we complete a comprehensive search for official mentions of the PITI program on the websites of government agencies, most activity is by provincial governments. While there is evidence of horizontal learning among proximate local governments for new and innovative policies (Ma, 2017), especially when concerted central pressure is present (Zhu and Zhang, 2016), our theoretical model does not predict that learning itself will drive increased compliance.

As further explored in SI Appendix F, we find positive spillover within provinces, which attenuates the treatment effects, making the treatment effects displayed in Figure 2 a lower bound. In our analysis of spillover, the direct effect of treatment is maintained, but the results also show that having another city within the same province treated has almost the same effect on compliance as the direct treatment. The effects of direct and indirect exposure to treatment are not additive, but rather interact negatively. While we cannot be sure whether spillover is driven by administrative pressure by provincial governments in response to monitoring or rational expectations of future monitoring, we suspect that a greater expectation of punishment for noncompliance drives the effect in light of our interviews with local officials (reported below).

### 4.3 Heterogeneous Effects

We pre-registered a number of tests for heterogeneous treatment effects, with the goal of better understanding the types of cities that respond to treatment. While we recognized at the outset of the project that we had limited power to detect heterogeneous effects, we considered it desirable to test for them to shed light on plausible reasons for treatment effects. In particular, we test whether treatment effects are greater in cities with higher pre-treatment PITI scores and more citizen micro-blogging about pollution and transparency. Cities with higher pre-treatment PITI scores may have political or structural characteristics that make them less resistant to increased transparency. Cities with more micro-blogging about pollution and transparency may have more engaged publics that would push for improvements to transparency based on disclosure of the PITI rating. We do not find that the treatment effect is conditional on pre-treatment PITI scores or citizen micro-blogging about pollution (SI, Figure D1). The model that shows the marginal effects of treatment on PITI based on pre-treatment scores has a point estimate in line with our prediction that treatment will have the greatest effect on already transparent cities, but the result is not inconsistent with the null hypothesis.

We also attempt to externally replicate the findings of [Lorentzen, Landry and Yasuda \(2013\)](#) about transparency being most likely to develop in cities with high budget revenues, low dependence on central transfers, and low large-firm dominance and the additional findings of [Van Aken and Lewis \(2015\)](#) that compliance with central government mandates is more likely with more state-owned enterprise economic activity, less regulatory autonomy, and more state capacity. Unlike [Lorentzen, Landry and Yasuda \(2013\)](#) we test whether cities with these characteristics are most likely to respond to a treatment aimed at prompting transparency, rather than just whether these characteristics are associated with transparency. We do not find heterogeneous treatment effects by budget revenues or dependence on central transfers. We replicate the main finding of [Lorentzen, Landry and Yasuda \(2013\)](#) and find that cities dominated by large firms are least likely to respond to treatment and increase transparency (SI, Figure D2). We do not find heterogeneous treatment effects from the additional characteristics studied by [Van Aken and Lewis \(2015\)](#) (SI, Figure D3). Taken

together, these findings suggest that the release of ratings by NGOs will be most effective when deployed for cities that do not face structural barriers to compliance such as large firm dominance. Nonetheless, these results should be considered exploratory because of low statistical power to detect heterogeneous treatment effects, particularly in light of many hypothesis tests.

## 5 Mechanisms and Scope Conditions

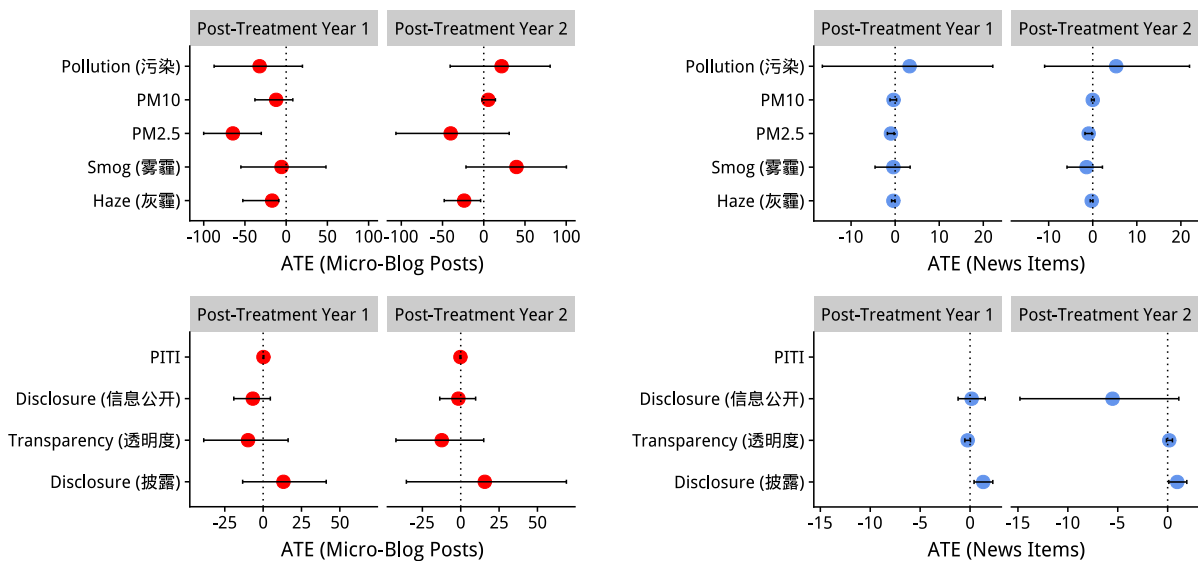
To probe whether the improved compliance comes about because of increased public discontent, we assess whether there is increased attention to pollution in micro-blogs, the media, or citizen petitions in treated cities. To assess the plausibility of reduced monitoring costs as a mechanism, gain insights on local-provincial-central government dynamics, and better define the scope conditions for the emergence of this form of governance in authoritarian settings, we conducted a series of interviews with 20 municipal EPB officials in our sample, seven NGOs that adopted the PITI intervention, and three local scholars from cities in our sample knowledgeable about local-central government dynamics.

### 5.1 Increased Public Discontent

We find little evidence that NGO disclosure of information about compliance increases public discontent, at least as measured by citizen and news media attention to pollution and transparency. Figure 3 shows the effects of treatment on discussions about pollution and transparency in citizen micro-blogs and the nationwide news media (see SI Appendix D for tabular results). While nationwide news media attention to haze and disclosure increase in treated cities as compared to control cities, citizen micro-blogging about “pollution (污染)” and “PM2.5” appears to decrease in treatment cities as compared to control cities. The fourteen remaining measures of citizen discussion and news coverage were indistinguishable in treatment and control cities. None of the officials we interviewed indicated significant public pressure around compliance with central mandates to disclose information about pollution (see SI Appendix G). The main treatment effect is not mediated by public discontent or media attention, indicating that this mode of governance may be a sustainable strategy even



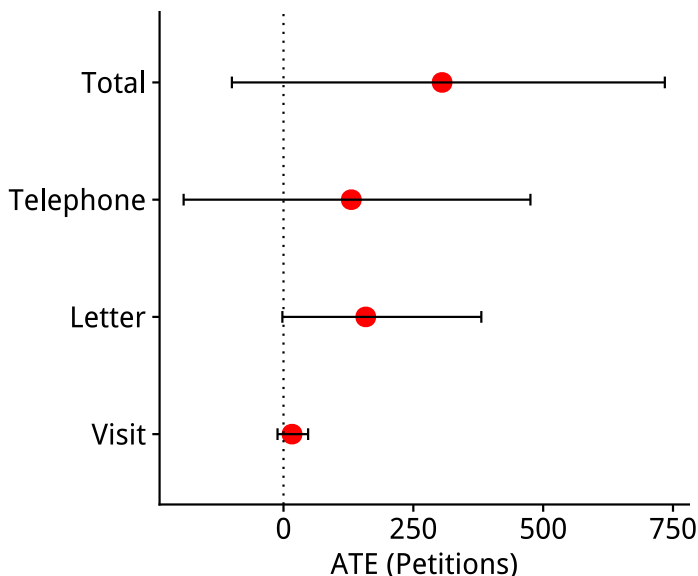
in authoritarian settings.



**Figure 3:** Treatment effect on citizen micro-blog and nationwide news media attention to pollution and transparency. *Notes:* Left column shows treatments effects on the number of Weibo posts from users associated with each sample city that contain the indicated phrase, with 90% confidence intervals derived from block-wise bootstrap sampling. Right column show treatment effects on the number news stories appearing in a Baidu search with the indicated phrase appearing in the headline, with 90% confidence intervals derived from block-wise bootstrap sampling. The pre-registered search phrases “PITI” never appeared in news headlines and is thus not displayed. Figure C1 shows similar results for full-text Baidu search of news media.

There is weak evidence that PITI facilitates the direct contact of citizens with municipal governments. Figure 4 shows the effects of releasing the PITI score on citizen petitions to municipal Environmental Protection Bureaus (see SI Appendix C for results in tabular format). Each point estimate of the effect of NGO monitoring on petitioning is positive, with total petitions ( $p = 0.13$ ) and letter petitions ( $p = 0.08$ ) having the highest levels of statistical significance. It is possible that the muted response in the number of petitions is due to the rapid compliance of treated cities following treatment. It is also possible that the positive effect is itself a function of the increased transparency of municipal governments, with the PITI treatment providing the basis for the public to petition. The lack of public and media attention combined with weak evidence of an increase in petitioning suggests that the public interpreted disclosure of monitoring by NGOs as a signal that they can directly demand responsibility by local governments, rather than as a signal that collective action to express discontent is acceptable. This provides a limited answer to questions about when the central government would allow civil society groups to monitor compliance – when their

activities do not generate collective action that threatens the government.



**Figure 4:** Treatment effect on citizen petitions. *Notes:* Display shows observed treatment effect on the average number of petitions submitted via various channels in post-treatment year 1, with 90% confidence intervals derived from block-wise bootstrap sampling. The Ministry of Environmental Protection has not released information on petitions for post-treatment year 2, so we cannot examine those effects.

## 5.2 Reduced Monitoring Costs

We conducted interviews with 10 city-level Environmental Protection Bureau officials from each of the treatment and control conditions, based on a randomly-ordered quota sample, for a total of 20 interviews. Our interviews tested knowledge of public disclosure requirements, probed the amount of higher-level pressure to improve transparency practices, and explored knowledge about the PITI score. The interview template and city-by-city summary of the responses to all items are available in SI Appendix G.

The interviews revealed some evidence that officials from treated cities paid greater attention to compliance, potentially because of sensitivity to detection by the central government. However, only a minority of the officials we interviewed were aware of the PITI program (5 of 10 in the treatment group; 3 of 10 in the control group), though we cannot guarantee that we reached the most knowledgeable official at each municipal EPB. Officials in the treated cities also did not have better knowledge about specific mandates to disclose information to the public than officials in control cities, although three of the officials from

treatment cities (and none from control cities) mentioned using information in the IPE report (released as part of the field experiment) to improve their transparency. Local officials in both experimental conditions are clearly sensitive to the directives coming from higher levels of government about the disclosure of information to the public. Every official said that they were receiving directives from higher levels of government to increase their disclosure of information to the public and that they used directives and official policy documents to track the requirements. Indeed, both treatment and control cities improved compliance over the study period. Yet, only officials in treated cities faced increased likelihood of exposure of noncompliance. Two officials in the treated cities commented that they felt the PITI score (released as part of the field experiment) was not capturing the full extent of their efforts to comply with transparency mandates, implying sensitivity to being rated as out of compliance. The differential change in transparency practices between treatment and control cities is most plausibly driven by an increase in the probability of being found out of compliance.

Given that the municipal officials might want to keep oversight from the central government in response to treatment secret, we also conducted three interviews with local scholars using the same questions as for local officials. The scholars largely confirmed that localities are sensitive to being found out of compliance. One scholar told us that the upper-level government undertook a large-scale inspection to see if the local EPBs had published information as required. After the inspection, the prefectural EPBs whose information disclosure was poorly done were publicly criticized by the upper-level government. However, the scholar noted that the overall frequency of inspections is not very high due to the high costs of monitoring compliance, and it has only taken place once in the past two years. Therefore, additional monitoring and disclosure by NGOs likely supplements upper-level government inspections. Each scholar also confirmed that the importance of environmental information disclosure was high, saying “the level of attention is quite equal to other work”, the level of attention is “at least above the medium level”, and “[t]he higher level government attaches great importance to information disclosure.” The interview template and the responses are available in SI Appendix [H](#).

### 5.3 Interviews to Probe Scope Conditions

We interviewed seven local NGOs that use the PITI evaluation methodology to monitor their own municipal governments in order to understand the limitations they face. The interview template and the responses are available in SI Appendix I. These NGOs indicated that they do not need to get approval from the local government before starting the PITI evaluation, but the PITI evaluation did help increase the frequency of communication between local NGOs and local governments. After each round of evaluation, the local NGOs generally send the report to the EPBs and some of them also invited the local EPBs to attend the conference when they publish the evaluations. Local NGOs generally report that the local governments value the PITI evaluation, since they want to improve their information disclosure to get a better score. They even indicated that the restrictions on domestic NGOs have been decreasing over time. However, they did suggest that restrictions on overseas funding have become more stringent with the new law on the Administration of Activities of Overseas Non-Governmental Organizations within the Territory of China that came into force on January 1, 2017<sup>7</sup>, and, in some regions, the approval process for organizing activities is becoming more complicated.

Some NGOs reported limited interference in their activities by the local governments in response to revelations of noncompliance. Two local NGOs reported that local governments that received low scores contacted them either to find out how to improve their score or even to sue them to cease the monitoring and disclosure. One NGO was asked by the EPB to suspend their activities during the annual political sessions in China (两会), but resumed after that. The local NGO that was sued indicated that the provincial EPB still encourages them to conduct the PITI evaluation, highlighting precisely the principal-agent logic of this mode of governance. One NGO confirmed that the government allows monitoring activity when it does not pose a risk of collective action by the public, saying they “planned to launch thousands of volunteers to carry out monitoring of rural drinking water. The drinking water safety issues are more sensitive, so it was canceled by the government.” Overall, the interviews suggest a relatively open space for monitoring and disclosure activities, so long

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<sup>7</sup>See <http://www.mps.gov.cn/n2254314/n2254409/n4904353/c5282857/content.html>

as these activities do not yield threatening collective action.

## 6 Discussion and Conclusion

Much effort has been made to close the “implementation gap” that emerged between the strong policies set by the central government and the poor implementation by local governments in China. Given the central government’s strong interest in both economic growth and environmental management —mandates that are often at odds —local governments can use their information advantages to avoid compliance with environmental mandates, including mandates to disclose information about pollution. With a national-scale field experiment, we show that the central government of China can utilize the efforts of NGOs to close this implementation gap and enhance the impact of directives. Our study provides strong, causal evidence that the disclosure of monitoring by a non-governmental organization increased the compliance of local governments with central mandates beyond what was achieved by central administrative pressures alone. In the first post-treatment year, compliance with transparency mandates increased 7 points more for the treatment group as compared with the control group. Both the treatment group and control group significantly increased in their transparency practices in the second post-treatment year, but the gap between them remained steady at approximately 7 points. These increases represent real changes in the degree to which cities make information regarding their regulation of pollution available to the public and to the central government. Monitoring by NGOs increased that compliance in the treatment group and the evidence suggests that reduced monitoring costs rather than increased public discontent led to this improvement. In sum, NGOs can play an important role in facilitating local compliance with central government mandates in authoritarian settings using monitoring and disclosure.

Our analysis suggests some scope conditions for the role that NGOs can play in monitoring local governments to improve compliance. First, the formal model requires that monitoring costs are high for significant noncompliance to emerge, which is more likely with complex, multi-faceted mandates. Second, the evidence on heterogeneous treatment effects indicates that municipalities with low structural barriers to compliance, like those without

large firm dominance, are better targets for effective monitoring and disclosure by NGOs. Third, NGOs appear to be limited to activities that do not generate collective action. The lack of an effect of the treatment on public attention and interview evidence of limitations on activities likely to generate collective action offer suggestive evidence that this mode of governance is allowed to emerge only when it does not lead to political instability (Chen and Xu, 2017). Other non-state actors like the media and universities may similarly be able to use disclosure to bring about improvements when they do not foster collective action.<sup>8</sup> Fourth, although local NGOs reported that they were not limited in their monitoring activity when they followed the PITI protocol, NGOs do face restrictions in other ways. Recent restrictions on NGOs in China have emerged for international NGOs and organizations funded by overseas groups. And there have been examples of NGOs that conduct monitoring being shut down by the central government when they also engage in critiques of the central government.<sup>9</sup> Authoritarian regimes, including China's, often place restrictions on non-state actors when actions create political instability and we stress that monitoring and disclosure is not without risk.

Our study has two main limitations that point to future work. First, our sample is selected such that our results represent an upper-bound on the treatment effect (although the analysis of spillover suggests that the upper bound is higher than the main effect). More studies of ratings in China and in other contexts are needed to establish the generalizability of the finding that NGOs can help to address compliance problems in authoritarian settings. Such results are now emerging (Malesky and Le, 2018). Second, we have only indicative evidence for the mechanism behind the treatment effect that we observe, in part because of the challenge of observing government-to-government relations in China. Future work might structure dissemination of monitoring in more precise and less-public ways, for example with an experimental treatment that disseminates monitoring only to central government agencies, to narrow down on the information channels that are operative. Nonetheless, we have strong causal evidence that governments change their actions in response to monitoring

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<sup>8</sup>See, for example, [http://www.dmhj.com/rd/201808/07/t20180807\\_6479091.shtml](http://www.dmhj.com/rd/201808/07/t20180807_6479091.shtml), accessed August 9, 2018, and examples in SI Appendix J.

<sup>9</sup>See for example the Unirule Institute, <https://www.nytimes.com/2018/07/11/world/asia/china-unirule-institute.html>, Accessed August 10, 2018.

by NGOs, a unique outcome in authoritarian governance.

Our study offers empirical support for a much broader set of theoretical predictions about authoritarian governance beyond our particular topic of study. The problems involved with multi-level governance and delegation between governments that we investigate in China are common around the world ([Konisky and Teodoro, 2016](#)). There is emerging evidence, within China where local NGOs have adopted the PITI scoring procedure in their localities and beyond China in other authoritarian and semi-authoritarian regimes, that NGOs can play a role in solving them by publicly disclosing the performance of governments. For instance, [Malesky and Le \(2018\)](#) report that the disclosure of an index rating local governments in Vietnam improved the quality and depth of administrative reforms by local governments mandated by the central government. These kinds of results indicate the broader emergence of new modes of authoritarian governance that we describe here beyond China (see also [Malesky and Merchant-Vega \(2011\)](#) across South and Southeast Asia and [Javeline and Lindemann-Komarova \(2010\)](#) and [Knox and Janenova \(2018\)](#) for more limited evidence in Kazakhstan and Russia). Within authoritarian settings, this research suggests that the plausibility of this mode of governance depends on having a central state with capacity to effectively reward or sanction compliance (per the formal model) and with enough power to prevent local governments from inhibiting NGO activity that reduces monitoring costs. Thus, NGO monitoring of local government compliance is not a panacea to overcome all problems associated with a weak state, but rather a targeted solution to local government noncompliance when the primary impediment to central oversight is the difficulty of monitoring.

Our study also adds to a growing body of research that explores the impacts of publicly rating governments ([Kelley and Simmons, 2015](#); [Cooley and Snyder, 2015](#); [Davis, Kingsbury and Merry, 2012](#)) and adds more definitive evidence that non-governmental organizations can use ratings to shape the actions of target governments at the domestic level even in authoritarian contexts. Indeed, NGOs and other types of non-state actors are increasingly disseminating ratings publicly in their attempt to gain influence in governance. Our study provides additional support for the argument put forward by [Bush \(2017\)](#) that ratings gain influence mainly by appealing to and being consistent with the interests of powerful audi-

ences. The results of our study point to new ways that NGOs can get involved in solving governance challenges even in authoritarian settings.

Because we study the role of NGOs in a setting where the central government has mandated transparency, this connects more broadly with related work on transparency. The treatment we study boosted transparency by city governments, which may have a number of important downstream effects that are the focus of our ongoing research. Transparency about performance has prompted governments to deliver public goods (Grossman and Michelitch, 2018) and curb corruption (Stromseth, Malesky and Gueorguiev, 2017, Ch. 3), so our results provide more reasons to be optimistic about this effect even where public pressure and non-governmental advocacy are limited. Transparency has long been a key tool in successful environmental management and evidence indicates that it can lead to improved environmental conditions in a variety of settings (Tietenberg and Wheeler, 2001). Some results indicate that these optimistic projection hold with the PITI ratings (Li et al., 2017). Our results thus raise the possibility that city governments in China will begin to address a public health crisis of global proportions caused by pollution.

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# Supporting Information

## Contents

A	Pollution Information Transparency Index (PITI) Details . . . . .	38
B	Dissemination of PITI Treatment . . . . .	48
C	Results in Tabular Format and Extensions . . . . .	49
D	Heterogeneous Treatment Effects . . . . .	55
E	Solution to Formal Model . . . . .	58
F	Spillover . . . . .	60
G	Interviews with Municipal EPB Officials . . . . .	63
H	Interviews with Local Scholars . . . . .	73
I	Interviews with Local NGOs . . . . .	77
J	Examples of Chinese NGOs' Monitoring and Disclosure Activities . . . . .	84

## A Pollution Information Transparency Index (PITI) Details

The Pollution Information Transparency Index (PITI) has been published since 2008 and the last report prior to our study in 2014 covered 120 core cities, with another 28 cities rated by local NGOs. The cities that were included in PITI prior to our study were purposefully chosen because they were cities designated for environmental protection in the 11th and 12th national Five Year Plans, cities designated for tourism, provincial capitals, and large cities of national importance, or evaluated by other local NGOs. Because these cities were already rated by PITI, they were not eligible to be part of our experimental sample.

PITI scores cities on their information disclosure related to pollutants and pollution sources, with a total possible score of 100 points. PITI provides both aggregate and component ratings of the transparency practices of cities. Each city is evaluated in four main categories: Environmental Supervision Information (50 points), Responsiveness (15 points), Enterprise Emission Data (20 points), and Environmental Impact Assessment Information (15 points). The relative importance of each category is reflected in the points allocated.



To ensure quality, when PITI was first launched, IPE solicited the opinions of a panel of experts in environmental protection, law, statistics, and other fields, whose feedback was incorporated into the evaluation methodology. In addition, IPE carried out a sensitivity analysis to assess how the rankings would be affected by different component weightings and scoring criteria. This sensitivity analysis showed a low level of sensitivity; the adjustment of weightings did not significantly affect the overall order of the ranking (IPE 2008).

All the components of PITI score are set according to China's current environmental laws and regulations, including the Regulations of the People's Republic of China on Open Government Information and the Ministry of Environmental Protection Measures on Open Environmental Information (Trial), Measures on Self-Monitoring and Information Disclosure of Key State-Monitored Enterprises (Trial), and Measures for Key State-Monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial). IPE sets criteria based on the laws and regulations and quantifies the compliance of local governments with legal requirements. Since most cities have adopted limited transparency practices and no cities in existing PITI releases approach the perfect transparency score, we are not concerned with ceiling effects.

We collected official data related to transparency by municipal governments in the area of pollution sources from January 1st 2014 to December 31st 2014 (pre-treatment) and then from January 1st 2015 to December 31st 2015 (Year 1 post-treatment) and January 1st 2016 to December 31st 2016 (Year 2 post-treatment), mainly from online data sources, including Environmental Protection Bureau websites, municipal government websites, and new media platforms. IPE publishes a detailed methodology of the scoring process (IPE 2016), which enabled us to replicate the IPE scoring for the cities in the experimental sample.

## **Supervision Records**

**Records of Enterprise Violations (23 pts):** This category rates the disclosure of the municipal Environmental Protection Bureau's (EPB) monitoring of pollution sources and the publication of these monitoring results, particularly the disclosure of data regarding excessive emissions from polluters. Other types of records of facility violations, including administrative penalties, reports on enforcement actions, and supervisory notices urging

violators to come into compliance within a given time frame, are also included.

The 23 pts are divided into 4 parts: systematicness (7 pts), timeliness (4 pts), completeness (8 pts), and user-friendliness (4 pts). The level of systematicness is measured by the ratio of the number of violation records disclosed by the local EPBs (b) to the number of violation records that are supposed to be disclosed (a), which is calculated based on an average ratio of pollution emission and violations in the 20 largest cities (e.g., 7 pts if  $b/a$  is greater than or equal to 1; 6.3 pts if  $b/a$  is greater than or equal to  $8/9$  and less than 1; etc.). The level of timeliness is determined by how often the violation information was published (e.g., 4 pts if daily; 3.2 pts if monthly; etc.). The level of completeness depends on how much critical information is available (e.g., +1.6 pts if the place and the time of the violation is provided; +1.6 pts if there are specific regulations or laws that the firm violated and specific emission standards; +1.6 pts if information about the concentration of contaminants is released). The level of user-friendliness is determined by whether the violation information is convenient for the public to access (e.g., +0.8 pts if there is a website search engine; +0.8 pts if there is a page or column specifically for violation information).

Principal Laws or Regulations: Measures on Open Environmental Information (Trial); Measures on Self-Monitoring and Information Disclosure of Key State Monitored Enterprises (Trial), and Measures for Key State-monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial); Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure.

**Enterprise Environmental Behavior (5 pts):** This category rates whether the municipal government disclosed gradings for enterprises (such as the color-coded rating: very good “green”, good “blue”, warning “yellow”, bad “red”) based on pollution control, environmental compliance, and violations.

The 5 pts are divided into 4 parts: systematicness (2 pts), timeliness (1 pts), completeness (1 pts), and user-friendliness (1 pts). The level of systematicness is measured by the ratio of the number of bad firms (coded as red) disclosed (b) to the number of bad firms that are supposed to be disclosed (a), which is calculated based on average ratio of pollution emission and firm gradings in the 20 largest cities (e.g., 2 pts if  $b/a$  is larger or equal to 1;

1.6 pts if b/a is greater than or equal to 8/9 and less than 1). The timeliness is a function of the time between the publication and creation of the firm ratings (e.g., 1 pts if the document is published within one month after the document is produced; 0.8 pts if the time difference is longer than one month and within three months). The completeness is measured by how much information about the color rating is published (e.g., +0.4 pts if there is firm name and color; +0.2 pts if the definition of the color is consistent with the laws and regulations). The level of user-friendliness is determined by whether the color rating information is provided in a format that is convenient for the public (e.g., +0.2 pts if there is a website search engine; +0.6 pts if there is a column or page specifically for this information).

Principal Laws or Regulations: Opinion on Accelerating the Implementation of the Enterprise Environmental Performance Assessment System; Enterprise Environmental Credit Evaluation Measures (Trial); Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure.

**Discharge Fee Data (2 pts):** This category rates the disclosure of discharge fees levied against polluters, including the basis for such fees, standards and procedures for levying fees, fees owed compared to actual fees gathered, and any waivers or discounts granted to facilities.

The 2 pts are divided into 4 parts: systematicness (0.5 pts), timeliness (0.5 pts), completeness (0.5 pts), and user-friendliness (0.5 pts). The level of systematicness is determined by how many months are covered during the evaluation period (e.g., 0.5 pts if 12 months; 0.4 pts if 9-11 months). The timeliness is a function of the time difference between creation and publication of the information (e.g., 0.5 pts if the document is published within 20 days after the document is formed; 0.4 pts if the time difference is longer than 20 days and within three months). The level of completeness depends on how much critical information is available (e.g., +0.1 pts if there is firm name; +0.1 pts if there is emission concentration). The level of user-friendliness is determined by whether the discharge fee information is provided in a convenient way for the public (e.g. +0.1 pts if there is a website search engine; +0.3 pts if there is a column or page specifically for this information).

Principal Laws or Regulations: Measures on Open Environmental Information (Trial);

Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure.

**Automatic Monitoring of Pollution Sources (20 pts):** This category rates the disclosure of the total volume of effluent emissions into air and water, pollution concentrations, applicable emission limit, as well as the status of compliance through provincial-level EPB self-monitoring platforms.

The 20 pts are divided into 4 parts: systematicness (5 pts), timeliness (5 pts), completeness (5 pts), and user-friendliness (5 pts). The level of systematicness is measured by the ratio of the total volume of monitoring data disclosed on the self-monitoring platforms in December (b) to the amounts of monitoring data that are supposed to be disclosed in December (a), which is calculated based on the Measures on Self-Monitoring and Information Disclosure of Key State Monitored Enterprises (Trial), and Measures for Key State-monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial) (e.g., 5 pts if  $b/a$  is greater than or equal to 0.8; 4 pts if  $b/a$  is greater than or equal to 0.6 and less than 0.8, etc.). The level of timeliness is based on the frequency of the publication of monitoring data (e.g., 5 pts if within 2 hours; 4 pts if longer than 2 hours and within 4 hours, etc.). The completeness is a measure of how much critical information is disclosed on the self-monitoring platforms (e.g., +1 pts if there is monitoring time and monitoring point; +1 pts if there is concentration information for major pollutants, including CO<sub>2</sub>, SO<sub>2</sub>; etc.). The level of user-friendliness is determined by whether the monitoring information is provided in a format that is convenient for the public (e.g., +1 pts if there is a provincial level platform; +1 pts if there is a map to show the locations of firms; etc.).

Principal Laws or Regulations: Measures on Self-Monitoring and Information Disclosure of Key State Monitored Enterprises (Trial), and Measures for Key State-Monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial); Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure.

## Responsiveness

**Verified Petitions and Complaints (7 pts):** This category rates the disclosure of information on the handling of environmental petitions and complaints received by EPBs and their resolution, including the subject of the petitions and complaints, the object of the complaint (the enterprise), whether or not the case has been accepted by the EPB, the status of the investigation, and the disclosure of any resolution.

The 7 pts are divided into 4 parts: systematicness (3 pts), timeliness (1 pts), completeness (2 pts), and user-friendliness (1 pts). The level of systematicness is determined by how many months are covered (e.g., 3 pts if 12 months; 2.4 pts if 9-11 months). The level of timeliness measures the time difference between the creation and publication of the relevant document (e.g., 1 pts if the document is published within 20 days after the document is created; 0.8 pts if the time difference is longer than 20 days and within three months; etc.). The completeness is a measure of how much critical information the local EPBs publish (e.g. +0.4 if the complaint letter is published; +0.4 if the status of petitions or complaints are disclosed). The level of user-friendliness is determined by whether the information on the handling of environmental petitions and complaints is provided in a format that is convenient for the public (e.g., +0.2 pts if there is a website search engine; +0.6 pts if there is a column or page specifically for this information).

Principal Laws or Regulations: Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure; Measures on Open Environmental Information (Trial).

**Response to Public Information Requests (8 pts):** This category rates responses to public information requests and whether the local Environmental Protection Bureau has established a standard and comprehensive system for responding to public information requests, including disclosure of information regarding request procedures, provision of accurate contact information, the establishment of special offices or personnel for handling public information requests, standard and timely response to requests, and efforts to improve public convenience in making information requests. In order to assess this, two public information requests were sent to each city being rated.

The 8 pts are divided into 4 parts: systematicness (2 pts), timeliness (1 pts), completeness (4 pts), and user-friendliness (1 pts). The level of systematicness is mainly determined by whether the local EPBs have set up a well-developed response system and give a complete reply (e.g., 2 pts if both of the two requests were replied to; 1.2 pts if only parts of the requests were replied to). The timeliness is based on how long the local EPBs took to provide the requested information (e.g., 1 pts if within 15 days; 0.8 pts if 16 days; etc.). Completeness is a measure of how much critical information the local EPBs provide in their responses (e.g., 4 pts if all the information is provided in detail; 3.2 pts if all the information receives a general reply in the form of a simple list; etc.). The level of user-friendliness is determined by whether it is easy for the public to make a request (e.g., +0.2 pts if there is an online platform; +0.2 pts if the telephone number is provided; etc.).

Principal Laws or Regulations: Measures on Open Environmental Information (Trial).

## **Enterprise Emission Data**

**Key Enterprise Emission Data (16 pts):** This category rates the disclosure of key enterprises' annual report and the quality of discharge information in the report, including annual pollutant emission and hazardous waste disposal, among other areas.

The 16 pts are divided into 4 parts: systematicness (4 pts), timeliness (2 pts), completeness (6 pts), and user-friendliness (4 pts). The level of systematicness is determined by how many firms publish their annual report (e.g., 4 pts if more than 80%; 3.2 pts if more than 40% and less than 80%; etc.). The level of timeliness is based on when the annual reports are published (e.g., 2 pts if earlier than January 31; 1.6 pts if postponed for one week; etc.). The completeness is a measure of how much critical information is in the annual reports (e.g., +1.2 pts if there is water or air emissions data; +1.2 pts if there is hazardous waste information; etc.). The level of user-friendliness is determined by whether it is easy for the public to find the annual reports (e.g., +1.6 if local EPBs construct a platform; +1.6 if the local EPBs share the information with media; etc.).

Principal Laws or Regulations: Measures on Self-Monitoring and Information Disclosure of Key State Monitored Enterprises (Trial), and Measures for Key State-monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial); Measures on Envi-

ronmental Management and the Registration of Hazardous Chemicals (Trial); Measures on Open Environmental Information (Trial).

**Clean Product Audit Information (4 pts):** This category rates the disclosure of the mandated cleaner production audit enterprise list, as well as the status of whether enterprises have released their key pollutant emissions. If the enterprises failed to disclose this data, PITI rates whether or not the EPB has released the key pollution emission data for enterprises.

The 4 pts are divided into 4 parts: systematicness (1 pts), timeliness (1 pts), completeness (1 pts), and user-friendliness (1 pts). The level of systematicness is mainly determined by how many clean product audit firms are published compared to the total number of clean product firms and whether the firms or local EPBs publish the emission information of the firms (e.g., 1 pts if more than half of the firms are published and more than 2/3 of firms released their emission information; 0.8 pts if less than 1/2 of firms are published and more than 2/3 of firms released their emission information; etc.). The level of timeliness is according to the time difference between the creation and publication of the relevant document or report (e.g., 1 pts if the document is published within one month after the document is created; 0.8 pts if the time difference is longer than one month and within three months;). Completeness is a measure of how much critical information firms or local EPBs publish (e.g., +0.2 pts if there is a firm list; +0.2 if there is information about the use of toxic and hazardous chemicals; etc.). The level of user-friendliness is determined by whether the information on the clean product audit is provided in a format that is convenient for the public (e.g., +0.2 pts if there is a website search engine; +0.6 pts if there is a column or page specifically for this information).

Principal Laws or Regulations: Provisional Measures for Clean Production Audit; Notification Concerning the Reinforcement of Pollution Source Environmental Supervisory Information Disclosure.

## **Environmental Impact Assessment Information**

**Environmental Impact Assessment Information (15 pts):** This category rates the disclosure of the full text of EIA reports, as well as the level of effort made by the EPBs

to gather public opinions and notify interested parties of their rights to administrative reconsideration and administrative litigation through media channels, community assemblies, public hearings, or other methods, which are required to be undertaken before there is an acceptance or rejection of any construction project's EIA.

The 15 pts are divided into 4 parts: systematicness (5 pts), timeliness (4 pts), completeness (3 pts), and user-friendliness (3 pts). The level of systematicness is measured by the ratio of the number of local EIA projects whose EIA report are published (b) to the total number of project that require an EIA (a) (e.g., 5 pts if b/a is 1; 4 pts if b/a is greater than or equal to 4/5 and less than 1; etc.). The level of timeliness is determined by whether the local EPBs widely notified the public about pending EIAs through a variety of media at the beginning of the EIA process and during the time when public opinions are solicited (e.g., +0.8 pts if there is a wide notice; +0.8 if there is a EIA public hearings; etc.). The level of completeness depends on how much critical information is available (e.g., +0.6 pts if there is a mention of the involved community; +0.6 pts if there are specific regulations or laws that the firm violated and specific emission standards; +1.6 pts if there are monitoring conclusions regarding compliance with EIAs). The level of user-friendliness is determined by whether the information on EIAs is provided in a format that is convenient for the public (e.g., +0.6 pts if there is a column or page specifically for the relevant information; +0.6 pts if there is an announcement of significant potential impacts through social media; etc.).

Principal Laws or Regulations: Notification to Issue the Construction Projects' Environmental Impact Assessment Government Information Disclosure Guidelines (Trial); Measures on Open Environmental Information (Trial); Provisional Measures for Public Participation throughout the Environmental Impact Assessment Process for Construction Projects.

### **Note on year-to-year changes**

In some years, IPE changes the weighting of the PITI index to match the evolving legal status of transparency rules for municipal governments. In our case, the baseline 2015 index (rating 2014 performance) and the post-treatment 2016/17 index (rating 2015/16 performance) are slightly different. In particular, the disclosure of "Non-state-controlled Key Pollution Sources" is a new item in the second-year evaluation, with a weight of 6 pts.



Accordingly, the weight of “Key Enterprises Data” decreased from 16pts to 12pts, and the weight of “Clean Product Audit Information” decreased from 4pts to 2pts.

We produced both the baseline 2015 and post-treatment 2016/17 index scores for each of the post-treatment year reported in this paper. We use the consistent baseline 2015 index scoring for all analyses. We released the post-treatment 2016/17 index score in partnership with IPE for each of the post-treatment years.

**Non-state-controlled Key Pollution Sources (6 pts):** Disclosure of a list of non-state-controlled key pollution sources required by the newly revised Environmental Protection Law issued in January 2015. Disclosure of monitoring data of non-state-controlled air pollution enterprises.

Principal Laws or Regulations: Law of the People’s Republic of China on the Prevention and Control of Atmospheric Pollution; Measures for the Disclosure of Environmental Information by Enterprises and Public Institutions; Measures on Self-Monitoring and Information Disclosure of Key State Monitored Enterprises (Trial), and Measures for Key State-monitored Enterprise Supervisory Monitoring and Information Disclosure (Trial); Environmental Protection Law of the People’s Republic of China.

### **PITI Scoring Process**

We collected primary data from the websites of municipal Environmental Protection Bureaus. After data collection, six trained evaluators blinded to the treatment assignment of each city conducted assessments of transparency for each municipality in accordance with IPE’s guidelines for assigning the PITI score. It takes approximately one person-week to collect and process data into a city PITI score. Every evaluator was asked to make a detailed record during the evaluation process, including data sources, scoring reasons, and decisions on all sub-scores. We applied a cross-check procedure within our research team and IPE further validated the rating in pre- and post-treatment waves of data collection.

To evaluate responsiveness to public information requests (see SI Appendix A), we made a public request without revealing the reason for the request and evaluated the responsiveness of the EPB to that request on the basis of how systematic it was, timeliness, completeness,

and friendliness. In the first-year evaluation, we requested all written decisions of administrative penalties in the third quarter of 2014 and a list of environmental impact assessment reports in the third quarter of 2014. In the second-year evaluation, we requested the number of written decisions on administrative penalties in the whole year of 2015 and a list of environmental impact assessments that involved public hearings. In the third-year evaluation, we requested the number of environmental impact assessments, a list of environmental impact assessments that involved public hearings, and the number of written decisions on administrative penalties in the whole year of 2016. Every year, we used the application form provided by IPE.

## **B Dissemination of PITI Treatment**

**Online Publication.** Every year between September and November, IPE published their report through two main new media platforms, WeChat and Weibo, which are the two most influential social platforms in China. The scores of the treated cities from our research team were included in the appendix of the IPE primary report in 2015, 2016, and 2017. Following this, we published the 2014, 2015, and 2016 PITI scores of the 25 treated cities through WeChat and Weibo in September 2015, November 2016, and November 2017 respectively. A number of other organizations forwarded our PITI report once it was released in these online platforms.

**Publication by IPE.** IPE mentioned our evaluation several times in their primary report and they sent their report to local Environmental Protection Bureaus after the online publications.

**Communication with EPBs.** After online publication, we sent our specific PITI report as well as IPE's primary report to the Environmental Protection Bureaus in the 25 treated municipalities to inform them of their PITI scores directly. We called them a week later to ensure that they had received the reports.

## C Results in Tabular Format and Extensions

For readers interested in baseline PITI Scores and components, mean values of scores and components by treatment group, and  $p$ -values of difference-in-differences tests conducted by randomization inference taking into account our blocked design, Table C1 displays the relevant information and corresponds to the estimates displayed in Figure 2. The same information for our measures of citizen and media attention to pollution and transparency from Weibo are displayed in Table C2 and C3, corresponding to Figure 3. Likewise, tabular information on citizen petitions corresponding to Figure 4 is available in Table C4.

As an additional check on our analysis using Baidu news media reports, we conduct the same search for articles using the pollution or transparency keywords and the names of the sample cities in the full-text of articles. The results displayed in Figure C1 do not lead to substantively different conclusions than reported in the main text.

**Table C1:** Treatment Effects on Overall and Component PITI Scores

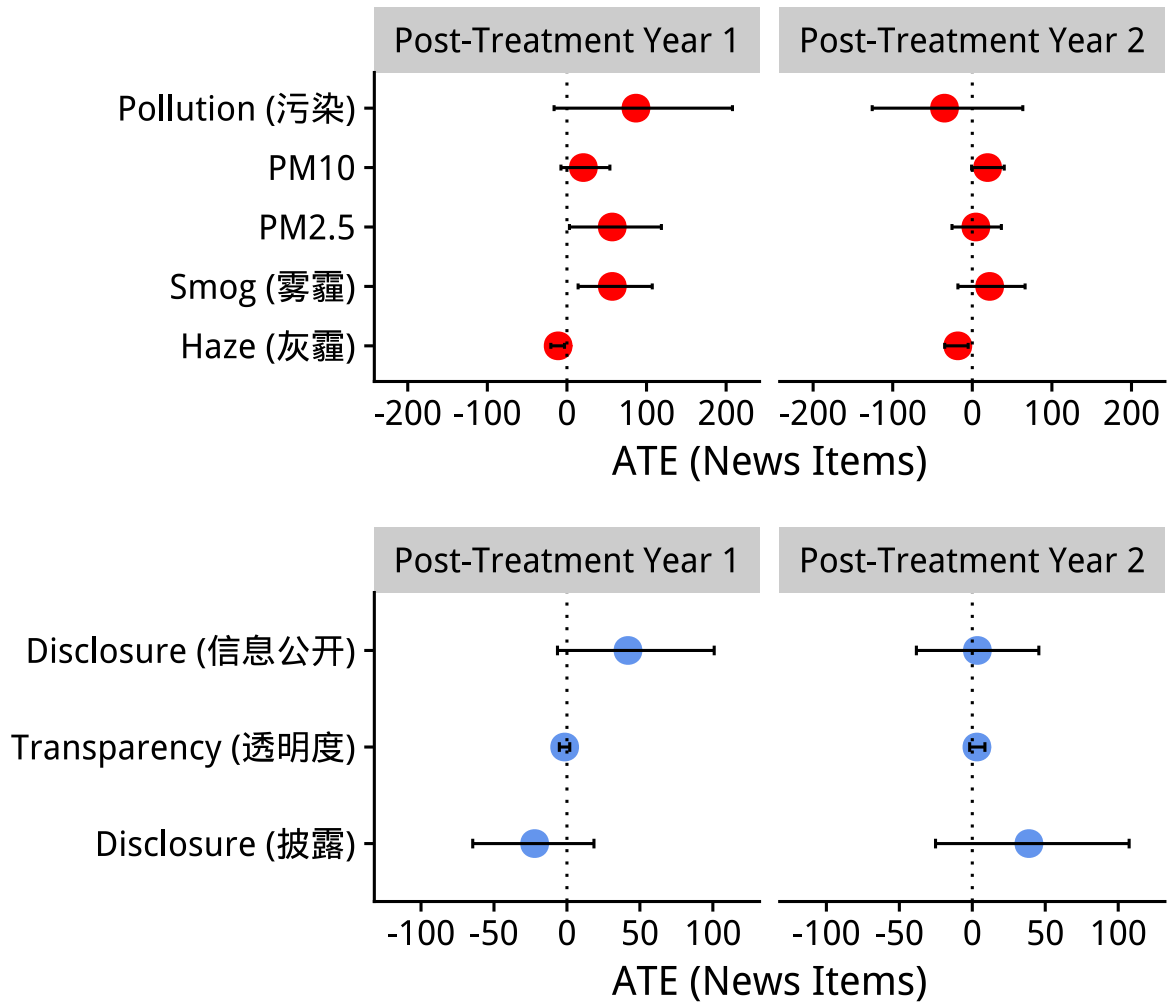
Indicator	Pre-		Balance t-test ( <i>p</i> )	Post1		Post1		Post1		Post2		Post2			
	Treated	Control		Treated	Control	ATE	<i>p</i> (RI)	Treated	Control	ATE	<i>p</i> (RI)	Treated	Control	ATE	<i>p</i> (RI)
PITI Score (100 pts)	39.92	39.80	0.97	48.83	41.46	7.26	0.01	53.37	46.34	6.92	0.06	53.37	46.34	6.92	0.06
Enterprise Violations (23 pts)	8.46	8.26	0.88	11.54	8.02	3.32	0.01	13.39	14.33	-1.14	0.71	13.39	14.33	-1.14	0.71
Environmental Behavior (5 pts)	0.71	0.04	0.01	0.42	0.14	-0.38	0.94	1.09	0.33	0.09	0.35	1.09	0.33	0.09	0.35
Discharge Fee (2 pts)	1.18	1.23	0.78	1.32	1.24	0.12	0.26	1.30	1.10	0.24	0.09	1.30	1.10	0.24	0.09
Pollution Monitoring (20 pts)	12.44	12.32	0.94	14.92	14.00	0.80	0.25	15.52	13.56	1.84	0.11	15.52	13.56	1.84	0.11
Petitions and Compliants (7 pts)	3.74	3.08	0.25	4.37	2.10	1.60	0.01	3.90	1.94	1.30	0.05	3.90	1.94	1.30	0.05
Public Requests (8 pts)	5.58	6.10	0.47	4.82	5.34	0.00	0.49	5.17	4.65	2.48	0.05	5.17	4.65	2.48	0.05
Key Enterprises (16 pts)	3.47	4.83	0.14	6.48	6.82	1.02	0.23	7.44	6.72	2.08	0.12	7.44	6.72	2.08	0.12
Clean Product Audit (4 pts)	0.82	1.12	0.16	0.74	1.05	-0.02	0.52	0.95	0.68	0.57	0.04	0.95	0.68	0.57	0.04
EIA (15 pts)	3.50	2.82	0.51	4.22	2.75	0.79	0.23	4.62	3.04	0.90	0.14	4.62	3.04	0.90	0.14





**Table C4:** Treatment Effect on Citizen Petitions about Environmental Issues

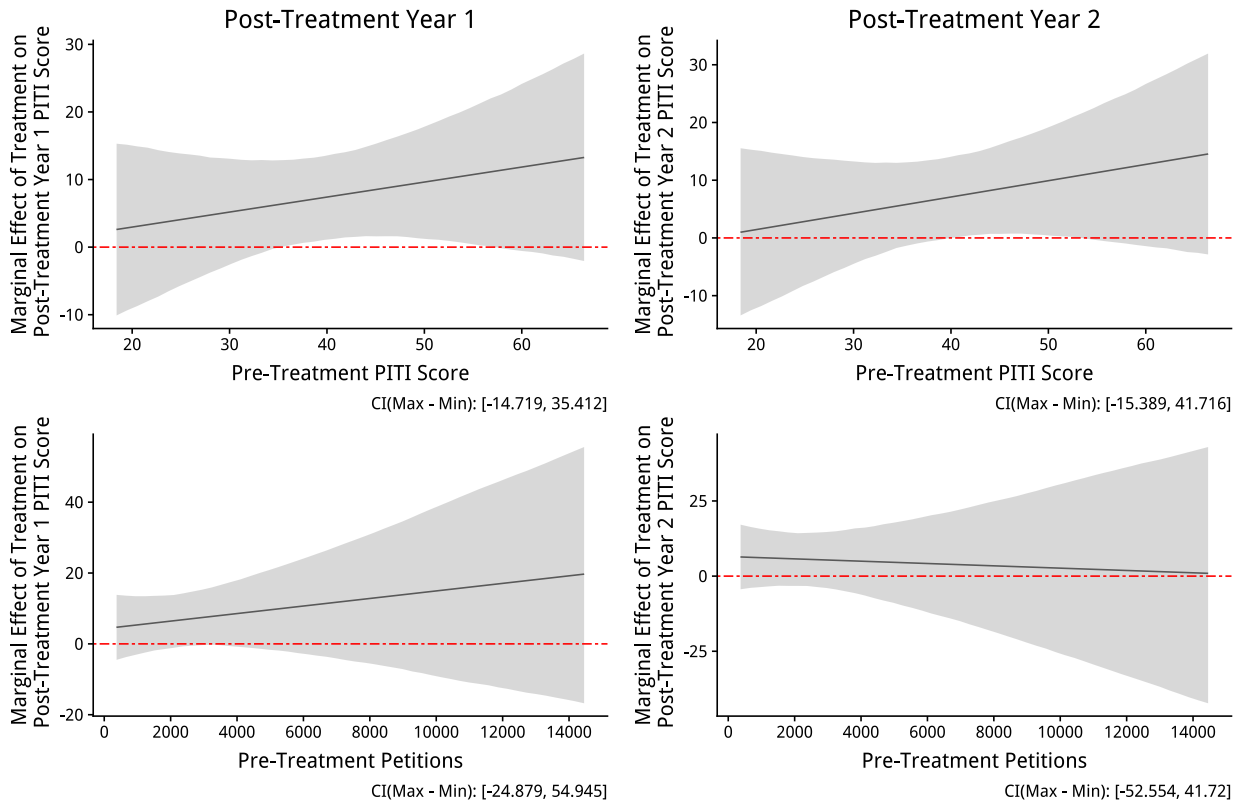
Indicator	Pre		Balance		Post1		Post1		Post1 $p$ (RI)
	Treated	Control	t-test ( $p$ )	Treated	Control	ATE	$p$ (RI)		
Citizen petitions (total)	3032.76	1827.04	0.15	3353.84	1842.76	305.36	0.12		
Citizen petitions (telephone)	2662.04	1467.84	0.12	2837.52	1512.80	130.52	0.28		
Citizen petitions (letter)	266.32	226.96	0.67	412.52	214.76	158.40	0.08		
Citizen petitions (visit)	104.40	132.24	0.30	103.80	115.20	16.44	0.19		



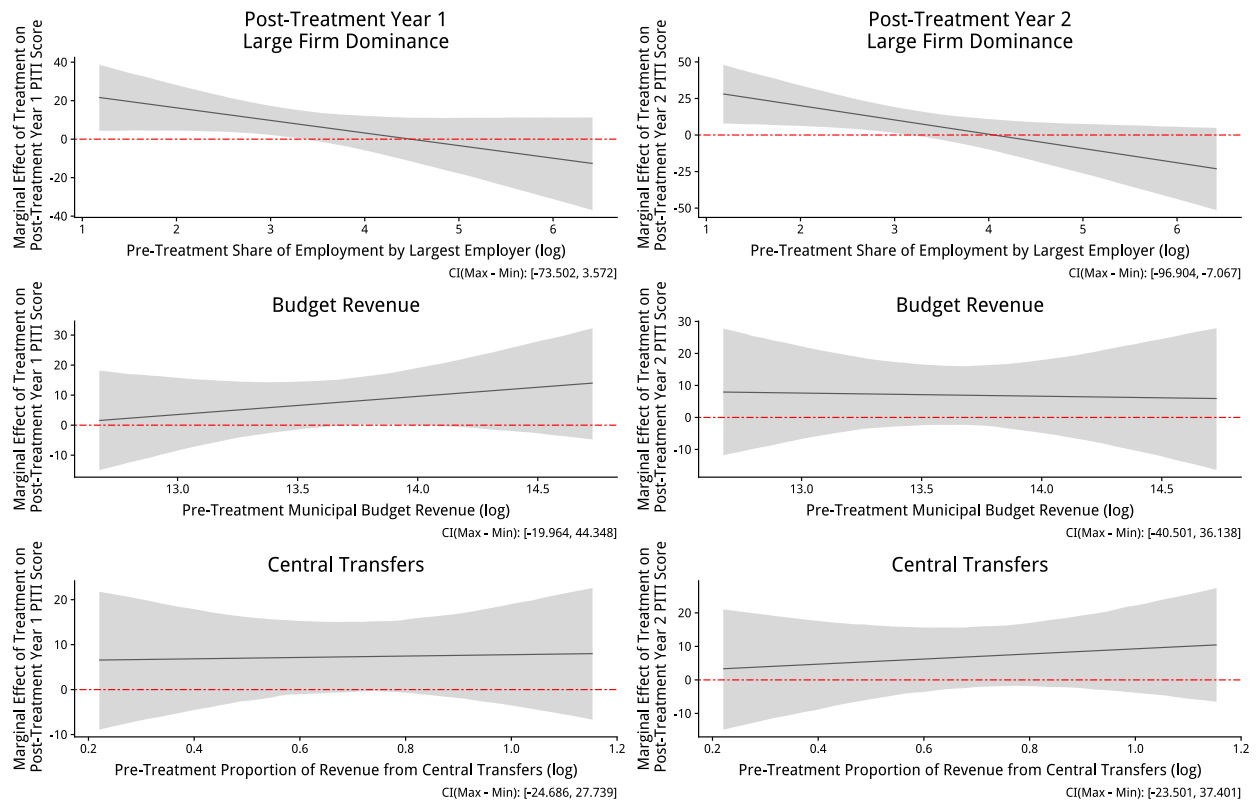
**Figure C1:** Treatment effect on nationwide news attention to pollution and transparency, using full-text Baidu searches.



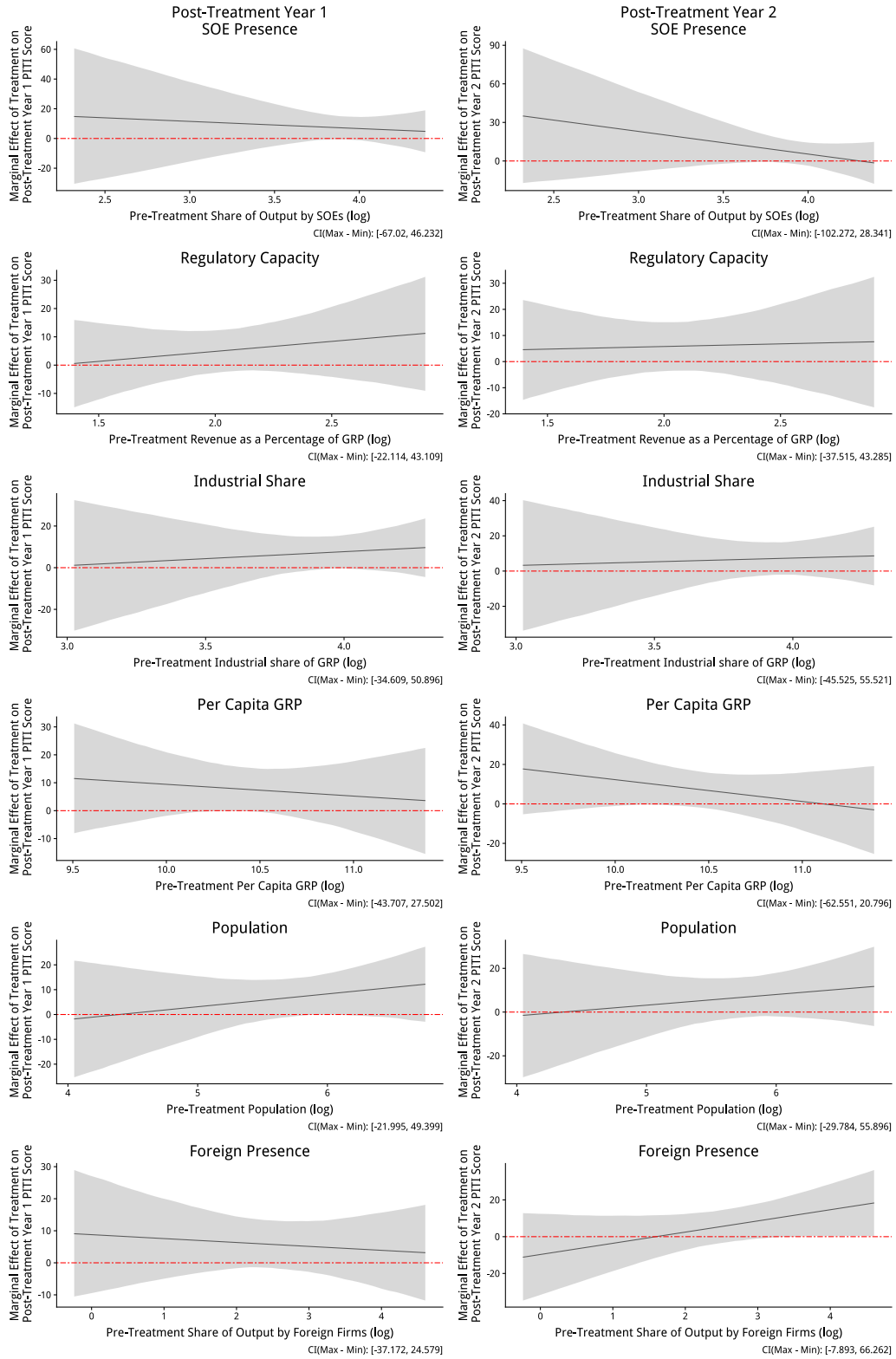
## D Heterogeneous Treatment Effects



**Figure D1:** Heterogeneous treatment effects by pre-treatment PITI score and pre-treatment citizen petitioning



**Figure D2:** Heterogeneous treatment effects by pre-treatment large firm dominance, budget revenue, and dependence on central transfers, extending the analysis in [Lorentzen, Landry and Yasuda \(2013\)](#).



**Figure D3:** Heterogeneous treatment effects by SOE presence, regulatory capacity, industrial share, per capita GRP, population, and foreign presence, extending the analysis in [Van Aken and Lewis \(2015\)](#).

## E Solution to Formal Model

As described in the main text, we consider the situation where the local government must decide whether to comply with a central rule, and the central government must decide whether to monitor for compliance and enforce the rule if noncompliance is detected. The payoff to noncompliance ( $N$ ) for the local government is increasing in the implementation costs avoided and rents available from collusion with other parties interested in noncompliance, which we parameterize as a scaling factor  $r$ . Local governments have varying levels of sensitivity to punishment (or the loss of benefits) from the central government indicated by scaling factor  $\eta$ . The central government makes a binary monitoring decision  $M$ . The utility of local governments related to noncompliance and monitoring is thus:

$$U_L = rN - \eta MN \tag{1}$$

The central government chooses whether or not to monitor local governments in a binary decision  $M$ , which is subject to a scaling factor  $c$  that indicates the cost of monitoring. We assume that at cost  $c$ , monitoring will correctly detect the compliance status of the local government. The central government incurs a cost for noncompliance in terms of public discontent, scaled by the amount of discontent  $\delta$ . If the center monitors, it will be able to recover some of its loss from any noncompliance through enforcement, given by a recovery parameter  $e$ . The central government thus has the following utility related to noncompliance and monitoring:

$$U_C = -\delta N - cM + e\delta NM \tag{2}$$

It is easy to show that the local government always chooses noncompliance if the central government does not monitor. When the central government does not monitor, the utility of the local government for noncompliance reduces to:

$$U_L = rN \tag{E1}$$

Thus the payoffs to noncompliance are always positive for local governments whenever

there are non-zero rents available for noncompliance. Likewise, it is easy to show that the central government always chooses not to monitor when the local government complies, since in this case the utility of the central government reduces to:

$$U_C = -cM \tag{E2}$$

Thus, we further assume that  $\eta > r$  (penalties exceed rents) and that  $e > c$  (recoveries exceed monitoring costs) to avoid the dominant strategies of noncompliance and no monitoring as best responses regardless of what the other player chooses. With this assumption in place, it is possible to show that there is no pure strategy Nash equilibrium. Consider the best response of the local government when the center chooses to monitor. In this case, the payoff to the local government is:

$$U_L = rN - \eta N \tag{E3}$$

Under the assumption that penalties exceed rents ( $\eta > r$ ), the best response by the local government to monitoring is compliance. But when the local government complies, it is not the best response of the central government to monitor. The same result can be shown in reverse. Consider the best response of the central government when the local government chooses noncompliance. In this case, the payoff to the central government is:

$$U_C = -\delta - cM + e\delta M \tag{E4}$$

Under the assumption that recoveries exceed monitoring costs ( $e > c$ ), the best response to noncompliance is always to choose monitoring. But when the central government monitors, it is not the best response of the local government to choose noncompliance.

Having shown that there is no pure strategy Nash equilibrium for this game, we consider the possibility of a mixed-strategy equilibrium, where both the local and central governments assign probabilities to their strategies and randomize. In particular, the local government chooses noncompliance with probability  $p_N$  and central government chooses monitoring with the probability  $q_M$ . Using these probabilities, we rewrite the utility of the local government and central government as:

$$U_L = rp_N - \eta q_M p_N \tag{E5}$$

$$U_C = -\delta p_N - cq_M + e\delta p_N q_M \tag{E6}$$

We then find the point at which probabilities  $p_N$  and  $q_M$  are mutual best responses. To solve for  $p_N$ , we find the maximum value of Eq. E5 under different scenarios. In our analysis of the pure strategies, we have already shown that  $p_N = 1$  when  $q_M = 0$  and that  $p_N = 0$  when  $q_M = 1$ . Considering the case where  $0 < q_M < 1$ , manipulating Eq. E5 we find that the local government is indifferent to any  $p_N$  when:

$$q_M = r/\eta \tag{E7}$$

Likewise, in our analysis of the pure strategies, we have already shown that  $q_M = 1$  when  $p_N = 1$  and that  $q_M = 0$  when  $p_N = 0$ . Considering the case where  $0 < p_N < 1$ , manipulating Eq. E6 we find that the central government is indifferent to any  $q_M$  when:

$$p_N = c/e\delta \tag{3}$$

The combination of Eqs. E7 and 3 give the mixed-strategy Nash Equilibrium. Both the central and local government have stable best responses at the points of mutual indifference given by Eqs. E7 and 3.

## F Spillover

To explore the possibility of spillover and test the robustness of our results, we evaluate the effects of spillover by mapping treatment onto a randomly assigned exposure of direct and indirect treatment. Specifically, we consider the assignment of treatment as a “direct” exposure to treatment. We consider the assignment of treatment to another city within the same province as an “indirect” exposure to treatment. Crossing these two kinds of exposures produces four possible exposure states.

Using this mapping, we can explore the causal effects of indirect exposure for cities

that have a positive probability of being assigned to all four exposure conditions. For cities that are always or never exposed to indirect treatment, we cannot assess the causal effects of indirect exposure, since there is no random variation in their exposure and thus their exposure status might be confounded by other factors such as geographic isolation or clustering that fix their exposure status. There are only four cities in the sample that can never be exposed to spillover at the provincial level because they are the only city from a province.

Of the 50 cities in the experimental sample, 23 cities have a positive probability of being exposed to each of the crossed direct and indirect exposure conditions. For these cities, we permute 50,000 iterations of our random assignment procedure within blocks to uncover the probability that each city is assigned to each of the four exposure conditions. We then model the difference in PITI scores from baseline to each of the two post-treatment years (the main outcome variable) in terms of direct treatment and indirect treatment, weighted by the inverse of the probability of the realized exposure state for each unit in this smaller sample. The results of this process are displayed in Table F1.

The results show significant intra-province spillover. The spillover attenuates the direct treatment effect since double exposure saturates and does not produce additive effects in both post-treatment years, though this effect is larger in the second post-treatment year. We do not have enough observations unaffected by potential spillover to estimate a treatment effect in the absence of spillover, but these results indicate that our estimate of the treatment effect is likely a lower-bound on the true direct effect.

**Table F1:** Direct and indirect treatment effects among cities potentially affected by provincial-level spillover

	DV: Difference in PITI Score from Baseline					
	1 Year Post-Treatment			2 Years Post-Treatment		
	(1)	(2)	(3)	(4)	(5)	(6)
Direct	8.901 (5.231) p=0.104	10.686 (4.737) p=0.036	12.660 (6.373) p=0.062	15.675 (7.201) p=0.042	19.368 (5.088) p=0.002	27.991 (6.182) p=0.0003
Indirect		11.899 (4.774) p=0.022	14.410 (7.188) p=0.060		24.621 (5.128) p=0.0002	35.589 (6.972) p=0.0001
Direct*Indirect			-4.639 (9.771) p=0.641			-20.272 (9.478) p=0.046
Observations	23	23	23	23	23	23
Adjusted R <sup>2</sup>	0.079	0.262	0.233	0.145	0.583	0.646
F Statistic	2.895	4.914**	3.224**	4.739**	16.384***	14.400***

Notes: two-tailed tests for direct and indirect treatment effects



## G Interviews with Municipal EPB Officials

We interviewed municipal EPB officials to gain better information about their knowledge of transparency standards, the pressures they face to comply with transparency standards, and their knowledge of the PITI process and rating. The goal of these interviews was to understand the incentives of local officials and to probe whether a reduction in central monitoring costs or an increase in public discontent were operative. We randomly ordered the cities in each of the treatment and control groups and then called the office number of each municipal EPB and asked to speak to a relevant official until ten individuals from each experimental group offered an interview over the phone. The interviewees are all EPB staff, but they do not all have equivalent positions, which are not listed for reasons of anonymity.

We embedded a test of knowledge within the interviews, where we asked officials to name all the requirements that they knew about to release information to the public. Enterprise violation data releases (6 of 10 in the treatment group; 7 of 10 in the control group) and environmental quality information (6 of 10 in the treatment group; 5 of 10 in the control group) were the two most mentioned. For other items in PITI, discharge fee data was mentioned by one city in treatment group; automatic monitoring of pollution sources data was mentioned 3 times in treatment group and 2 times in control group; verified petitions and complaints information was mentioned 2 times in treatment group; response to public information requests was mentioned by one city in treatment group; enterprise emission data was mentioned 2 times in treatment group; environmental impact assessment information was mentioned by one city in treatment group. For items outside PITI, personnel changes, environmental laws and regulations, and administrative examination and approval information were also mentioned.

**1. What kinds of information about environmental regulation and pollution does the central or provincial government require your agency to disclose to the public?**

**C1:** The most important item is environmental monitoring information. Specifically, we disclose air quality, drinking water quality, and sources of pollution twice a month. However,

we are not in charge of disclosing the automatic monitoring data of pollution sources. We just establish a monitoring facility and enterprises disclose the real-time data themselves.

**C2:** In the beginning of 2017, the municipal government issued annual key tasks and required us to promote the whole process of environmental information disclosure, make more efforts to disclose enterprises' violation information, respond to public requirements in a timely manner, and disclose drinking water quality every month.

**C3:** We have specific requirements but I can't remember all of them. They mainly include the list of key enterprises, air quality information, drinking water quality, and enforcement of environmental law.

**C4:** We have a specific policy document from the provincial government, and you can find it on our website.

**C5:** Administrative penalty and administrative licensing.

**C6:** Project approval information, enforcement of environmental law, punishment information, air quality information, and water quality monitoring information.

**C7:** We have put all the required information on our website including announcement, disclosure of administrative approval, budget information, personnel appointments and dismissals, monthly report of environmental quality monitoring, monthly report of water quality of key river basin, law and regulations, pollution source monitoring and enforcement.

**C8:** We are only responsible for the process of disclosure. Different departments are in charge of different items. We are not very clear about the specific contents.

**C9:** We are required to disclose information on regulations, enterprises' illegal acts, and punishment information.

**C10:** There are a lot of items, including the enforcement of law, administrative penalties, monitoring information, EIA information, law and regulations. I'm mainly responsible for the disclosure of law and regulations.

**T1:** We are mainly required to disclose information on environmental quality (air, water, and noise). We are also required to disclose self-monitoring information of key enterprises and information on corporate annual discharge of pollutants.

**T2:** Administrative punishment, administrative examination and approval, air quality, and water quality.

**T3:** Environmental monitoring information, including air quality, drinking water quality, and sources of pollution. If you want to know details you can find all the information on our website. We have put all the required information on our website.

**T4:** Such as environmental quality, budget, law and regulations, and responses to applications. I can't remember other. You can find them on our website.

**T5:** Monitoring information and discharge information.

**T6:** You can find them on the website. Mainly including environmental law and regulations, rules, standards and other normative documents, environmental protection plans, environmental quality, environmental statistics and environmental survey information, contingency plans and forecasting for environmental emergencies, discharge of pollutants, EIA information, discharge fee information, administrative punishments, petitions, and so on.

**T7:** We have disclosed all the required information on our website, such as administrative punishments.

**T8:** You can find them on our website, including environmental quality, enforcement information.

**T9:** Mainly about administrative inspections, petitions and their handling, NPC and CP-PCC proposals, annual budget, and environmental protection plans.

**T10:** We are required to disclose a lot of environmental information, including environmental law and regulations, the use of rights, administrative approvals, administrative penalties, and personnel changes.

## **2. What information sources does your agency use to keep track of these requirements?**

**C1:** We have specific policy documents including all the requirements – some items are required to be disclosed regularly, and some are required to be disclosed if the public applies. For environmental monitoring information, I didn't get a specific policy document but I know this information must be disclosed.

**C2:** We disclose information according to the "Regulations of the People's Republic of China on the Disclosure of Government Information", "Measures for the Disclosure of Environmental Information of the MEP (Trial)" and "Opinions of the Municipal Government Office and

the Municipal Party Committee on the Overall Promotion of Open Government Affairs” (Huangbanfa [2016] No. 59).

**C3:** We disclose information according to policy documents. It is written clearly which need to be disclosed, which don't, and which should be disclosed upon public application.

**C4:** We disclose information according to the policy document. We are required to establish a column called environmental information disclosure of enterprises, and you can find it on our website.

**C5:** The higher-level governments issued laws and regulations, and we disclose information according to them. We also have our own list of items.

**C6:** We disclose information according to relevant documents, combined with the actual situation.

**C7:** We disclose information according to the requirements by upper-level governments. They clearly list what should be disclosed.

**C8:** We have specific policy documents.

**C9:** It is mainly conveyed through policy documents. We also realized some from internal meetings.

**C10:** From national and provincial policy documents.

**T1:** Mainly through policy documents.

**T2:** Policy documents from upper-level governments.

**T3:** The municipal government issued key tasks every year, and we also have our own list of items.

**T4:** Environmental Information Disclosure Methods issued by MEP, and other relevant policy documents.

**T5:** We disclose information according to policy documents.

**T6:** Policy documents.

**T7:** Through policy documents and internal meetings.

**T8:** There are policy documents.

**T9:** Mainly through policy documents.

**T10:** On the one hand, we disclose environmental information mainly according to policy documents. On the other hand, we also disclose information based on our daily enforcement

activities.

**3. Has any national or provincial ministry approached your agency in the previous two years about improving environmental information disclosure? When and why?**

**C1:** Yes, upper-level governments are paying more and more attention to the construction of the website for information disclosure. We are also making more efforts. I've just participated in a training on information disclosure and website construction held by the EPB of Guangxi province last week.

**C2:** The municipal government issued key tasks every year, requiring all the departments to promote information disclosure.

**C3:** Yes, the upper-level government issued requirements every year, usually in the second quarter.

**C4:** Yes, the upper-level government issued policy documents every year.

**C5:** Yes, and we are also making progress as required. It started two years ago.

**C6:** Every year, the upper-level governments issued documents to promote information disclosure of all the department, and there was an assessment at the end of the year.

**C7:** Yes. For example, in 2016, there were two documents issued related to information disclosure.

**C8:** Yes, we received a policy document last year.

**C9:** Yes, and it is becoming stricter year by year.

**C10:** Yes. There is an inspection every year. It is not noncompliance, it is illegal.

**T1:** Yes. They issue policy documents every year. It started several years ago. I can't remember when exactly it started.

**T2:** Yes. We have an assessment every year.

**T3:** Yes, it is becoming stricter year by year. Except for some confidential information, all the other information should be disclosed.

**T4:** Yes, and we have an assessment every year.

**T5:** Yes. They are emphasizing information disclosure all the time.

**T6:** Yes, we have each year's key tasks.

**T7:** Yes. I can't remember the specific time.

**T8:** Yes, every year, they issued a document in the first half of the year.

**T9:** Yes. The higher-level governments urge us by issuing policy documents every once in a while, but I can't remember the specific time.

**T10:** Yes, several policy documents have been issued requiring us to step up efforts to disclose environmental information. I can't remember the specific time.

**4. If yes, what did the national or provincial ministry request that your agency do in the future about environmental information disclosure?**

**C1:** My responsibility is to disclose information required by upper-level governments but I don't know what's more. At least, as I mentioned before, environmental monitoring information is required.

**C2:** Modular management and dynamic update.

**C3:** For the disclosure channel, we are required to disclose through several platforms, including municipal government website and local EPB website. For the disclosure content, we just need to disclose information according to the policy documents.

**C4:** I can't remember the specific requirements but we can find all the requirements from the document.

**C5:** Yes, our city has set up a platform for information disclosure.

**C6:** Air quality information should be disclosed in real time. I'm not clear about other requirements.

**C7:** We are assessed by the upper-level government every year. Last year, we won the third place in the appraisal of all departments in the city. This is enough to prove that the environmental protection department attaches great importance to information disclosure. We are required to report the disclosure of environmental information quarterly, semi-annually and annually.

**C8:** For the disclosure channel, we are required to disclose through a website. We are required to disclose many kinds of information, including EIA information.

**C9:** Except for some confidential information, all the rest is required to be disclosed. We are mainly required to disclose through the website, and we are also required to send the

paper-based documents to upper-level governments.

**C10:** I'm mainly required to disclose law and regulations through websites. Some are also required to be disclosed through newspaper and media.

**T1:** All the requirements are listed in the policy document, and we just need to meet them.

**T2:** I can't remember all of them but you can find them on our website. If you don't disclose information in a timely manner, then you won't pass the assessment.

**T3:** They have a list for us to disclose, including some key areas.

**T4:** We are required to disclose information regularly. We are also required to disclose information according to public applications within a certain time.

**T5:** We are required to disclose all the information not only through our official website but also through Weibo and WeChat.

**T6:** It depends on the specific document, mainly including air quality, water quality, and enforcement of environmental law.

**T7:** You can find them on our website.

**T8:** We are required to disclose information through new channels – “Two Wei” referring to Weibo and WeChat.

**T9:** We should disclose environmental information on both the EPB website and the municipal government website.

**T10:** All the requirements are listed in the policy documents including the content and the time-frame.

## **5. What importance do you think the central and provincial governments attach to environmental information disclosure? Why?**

**C1:** I haven't been working here very long. However, as far as I know, the government now is attaching great importance to information disclosure, much more attention than before. For example, we are required to disclose information through new channels – “Two Wei” referring to Weibo and WeChat.

**C2:** Very concerned. At the open government affairs conference, the leaders stressed that to strengthen the disclosure of environmental information is the key task at present. They also mentioned that the public has an urgent need to acquire environmental information so

we must strengthen it.

**C3:** Very concerned. Because people from information center often urge me to disclose information.

**C4:** I think they are attaching great importance to information disclosure because according to a document called No. 31, we will be punished if we don't satisfy the requirements.

**C5:** Very important. Now, the environmental punishment information is an important part of enterprises to be selected as an advanced pacesetter or not.

**C6:** They attach great importance to information disclosure. There is a system of assessment, and there are relevant documents which we can use to know what we should do every year.

**C7:** They attach great importance to information disclosure. They conduct a regular inspection, assessment, and accountability.

**C8:** Quite important. The upper-level government issued several laws and regulations. They also conduct inspection and assessment.

**C9:** They attach great importance to information disclosure. They issue documents very often, and they conduct a regular inspection.

**C10:** Very important. Because it is required by law.

**T1:** Environmental information disclosure is one of the most important tasks of environmental protection. I think the higher authorities attach quite much importance to it because the central government nowadays wants to improve environmental quality and has issued a lot of regulations.

**T2:** Very important. Because it involves people's livelihood. The public is very concerned about environmental quality, so we disclose it every day.

**T3:** Very important. Every six months, there is an assessment. If you don't pass the assessment, they will ask you to rectify.

**T4:** They attach great importance because the disclosure of environmental information is linked to our bonus.

**T5:** I think they attach great importance to it because if we don't make it public, we will be criticized and accountable.

**T6:** The disclosure of environmental information has always been very important. Every



year, we are required to report our work.

**T7:** Very important. We are under supervision every day.

**T8:** Quite important. They issued policy every year.

**T9:** They attach great importance to it because they hold an internal meeting every one or two months.

**T10:** The higher-level governments attach great importance to it and will continue to strengthen it later. Because governments need to let the public know what they have carried out.

**6. Has your agency interacted with any social organizations about your environmental information disclosure practices? If so, please describe the interactions.**

**C1:** We haven't had any interactions with any social organizations.

**C2:** We have interacted with them through the form of information disclosure application.

**C3:** We didn't have interactions with local NGOs, but we often receive information disclosure applications from NGOs outside the city. We have always provided them with the information in accordance with the policy document.

**C4:** We haven't had any interactions with any social organizations.

**C5:** I know there's a local NGO but it has just established so there haven't been many interactions.

**C6:** I don't know whether there was a cooperation, but we have received information disclosure application from NGOs several times.

**C7:** Our website has message boards. All the social organizations and the public can apply for information there.

**C8:** No interactions.

**C9:** Yes, there were several interactions with local environmental groups about promoting environmental knowledge, especially on Environment Day.

**C10:** Our local NGOs have started relatively late compared to developed areas. At present, there are only two institutions, and they are still at origin stage. However, we have involved them in the process of policy design.

**T1:** I think local NGOs are not interested in environmental information so we feel that there's no need to interact with them.

**T2:** We have some activities on Environment Day. We don't have much interactions with NGOs.

**T3:** No interactions.

**T4:** No interactions.

**T5:** We haven't interacted with them but we have had some interactions with the public.

**T6:** We don't have much interactions with NGOs.

**T7:** You can find them on our website.

**T8:** Yes, they supervise our work.

**T9:** Yes, some NGOs left us messages on our website and we also communicated with them through Weibo and WeChat.

**T10:** Yes. For example, we conducted a series of environmental protection activities on Environment Day to strengthen the interaction with local NGOs, but the activities might not be limited to environmental information disclosure.

**7. Has your agency heard about the Pollution Information Transparency Index? If yes, how did your agency use the information and how could the program be improved?**

**C1:** Never heard before.

**C2:** Never heard before.

**C3:** Never heard before.

**C4:** Never heard before. Maybe other people in our department knows but I don't.

**C5:** Yes, I have heard of it before. I remember someone sent us a report. We haven't used it. I think they should expand its popularity and influence on governments.

**C6:** Never heard before.

**C7:** Never heard before.

**C8:** Yes, I have heard of it from the website. We haven't used it.

**C9:** Never heard before.

**C10:** Yes, I have heard of it from the website but I don't know much about it. We haven't

used it.

**T1:** Yes, I have heard of it from phone call. We use the PITI index selectively, mainly as a reference. I think the PITI is a bit one-sided and cannot fully reflect the work we have done. If you want to continue this kind of work in the future, you should also contact with the local EPB more.

**T2:** Never heard before.

**T3:** Never heard before.

**T4:** Never heard before.

**T5:** Yes, I have heard of it through the Internet and internal government exchanges. We haven't used it. I think they should communicate with local governments more.

**T6:** Never heard before.

**T7:** Never heard before.

**T8:** Yes, I have received their reports but I don't know the details. We used it as a reference.

**T9:** Yes, I have heard of it. We are considering using it to improve our work because people are concerned with environmental protection. For example, we will establish a column on our website as required in PITI. (A few days after the interview, after we sent them the PITI report, they called us to ask for more detailed information about PITI. They wanted us to tell them how to improve their work to get a higher score.)

**T10:** Yes, I have heard of it through news and media. We have used it in the daily work of environmental information disclosure. For example, we have made improvement if there was a specific advice in their report. However, we still mainly used policy documents. Of course, PITI work is good, but sometimes it takes more to catch small things that are a little too small in scope and hope they can be improved in the future.

## **H Interviews with Local Scholars**

It is possible that local officials at municipal EPBs would not fully report the kinds of public or central pressures that they faced to comply with transparency standards related to pollution. As a check on the data gathered through interviews with officials, we also contacted three local scholars based at research institutes in the sample cities with close knowledge of local environmental policy (S1 is from the treatment group; S2 and S3 are from

the control group). We asked them the same questions as the EPB officials to corroborate the information received from local officials. In general, we do not see any major divergences between the responses of knowledgeable local scholars and municipal EPB officials.

**1. What kinds of information about environmental regulation and pollution does the central or provincial government require local government to disclose to the public?**

**S1:** There is a lot of information that needs to be disclosed. We have a specific policy that includes a detailed list of environmental information disclosure items. Each level of the EPB needs to use a uniform catalog of requirements and standards for public content. Therefore, the environmental information disclosure column of each EPB's website has corresponding items that are required to be disclosed, but the quality of the content, such as the frequency and timeliness, may vary. The content to be disclosed includes, for example, information about the personnel of the EPB, the environmental quality information, and the specific information on the EPB's activities. For firm information, the EPB needs to disclose information about firms' permits, monitoring information which includes both self-monitoring and supervisory monitoring, annual statistical data, etc. There are also information disclosure requirements for the firm itself.

**S2:** There is a unified platform across the county, including basic information about enterprises, monitoring programs, and monitoring results.

**S3:** There are mainly three kinds of information that need to be disclosed: 1) the information on the approval of environmental impact report and administrative license; 2) the administrative penalty decision letter for enterprises; 3) the environmental quality information, including the monthly report of environmental quality, etc.

**2. What information sources does the local EPB use to keep track of these requirements?**

**S1:** There is a specific policy document. Every EPB's website is built according to the information disclosure directory. Regardless of the quality of the actual content of the information disclosure, all the required information is covered in the information disclosure

column. However, it is possible that some local EMPs didn't meet the standard of information disclosure quality required by the policy. The difference in the quality of the disclosure is mainly caused by the different attitudes and abilities of the EPBs.

**S2:** We have a specific policy document. It mainly requires the disclosure of monitoring data. The document can be found online.

**S3:** Local EPBs have policy document from upper level governments.

**3. Has any national or provincial ministry approached the local EPB in the previous two years about improving environmental information disclosure? When and why?**

**S1:** In the past two years, the upper-level government has had a large-scale inspection to see if the local EPB has published information as required, such as whether the timeliness of the disclosure has met the requirements. After the inspection, the prefectural EPBs whose information disclosure was poorly done were criticized by the upper-level government publicly. However, the overall frequency of inspections was not very high; it only happened once in the past two years.

**S2:** The requirements for information disclosure have been strengthened, especially in terms of air quality and monitoring data.

**S3:** In the past two years, there was no specific requirement to strengthen information disclosure.

**4. If yes, what did the national or provincial ministry request the local EPB do in the future about environmental information disclosure?**

**S1:** In the past two years, the requirements of the disclosure of environmental quality monitoring information have been paid the most attention. The upper-level government has high requirements for the timeliness and accuracy of data disclosure. If the data is not disclosed in time or there is fraud, the penalty will be very serious. In addition, all information is required to be published online.

**S2:** I feel that [redacted] province has always been very demanding for environmental information disclosure. Not only for environmental protection, food safety and water source

information disclosure requirements have also increased.

**S3:** In the past two years, there was no specific requirement to strengthen information disclosure.

**5. What importance do you think the central and provincial governments attach to environmental information disclosure? Why?**

**S1:** The MEP attached great importance to the disclosure of environmental information these years. Although it is not the most important work compared to all other government work, at least the level of attention is quite equal to other work.

**S2:** The MEP attached great importance to the disclosure of environmental information, which cannot be said to be particularly important compared to other work, but at least above the medium level.

**S3:** The higher level government attaches great importance to information disclosure. Environmental information mainly involves two categories. The first category is administrative licensing or administrative penalty information. Such information is highly relevant to enterprises, and such information is required to be publicized in the administrative licensing or administrative penalty process. The second category is environmental quality, which is highly relevant to the public.

**6. Has the local EPB interacted with any social organizations about environmental information disclosure practices? If so, please describe the interactions.**

**S1:** There is no specific cooperative activities and partnerships. However, environmental NGOs often apply for environmental information disclosure.

**S2:** In [redacted] province, there is an annual social work open day. Governments and social organizations organize activities together to disclose information on corporate pollution, sewage treatment plants' pollution, and landfills to the public.

**S3:** Yes, environmental organizations such as Lvya Environmental Protection Association publish information on their activities on the EPB website.

**7. Have you heard about the Pollution Information Transparency Index?**

**If yes, how did local EPB use the information and how could the program be improved?**

**S1:** I have not heard of it.

**S2:** I have not heard of it.

**S3:** I have not heard of it.

## **I Interviews with Local NGOs**

We also conducted interviews with seven local NGOs that have adopted the PITI process to rate their local EPBs on compliance with transparency standards. The goal of these interviews was to collect data on the kind of opportunities and restrictions faced by NGOs when they monitor and disclose information on the performance of local governments. By understanding opportunities and restrictions, we are better able to establish plausible scope conditions on when the mode of authoritarian governance that we describe will likely emerge. In general, we found that local NGOs face few restrictions in pursuing this mode of governance and are sometimes encouraged by higher levels of government. We sought to speak to all local NGOs using PITI and conducted interviews over the phone.

### **1. When did your organization start PITI evaluation? Why did your organization decide to complete PITI evaluations?**

**N1:** We started PITI evaluation in 2016. In 2015, we mainly used internal application method to promote local governments' information disclosure, and we found it was not effective. Few local governments responded our requests at that time. At the same time, we noticed that IPE had conducted PITI evaluation for about six years and we thought their assessment was more scientific and mature, so we contacted them to join them.

**N2:** We have been evaluating PITI since 2014. I'm not very clear about the reason since I just took over the PITI work last year.

**N3:** It was started in 2016. I'm not very clear about the reason.

**N4:** We started PITI evaluation in 2012 because at that time NGOs across the country were trying to promote the information disclosure of local governments. Just as IPE had an evaluation guide (PITI), we believed that we could start the information disclosure work by

doing PITI.

**N5:** We have just started the evaluation in 2017. We have just evaluated one city for one year so far. The reason is we feel that information disclosure is useful for environmental protection. Actually, we had done some related work to promote information disclosure before that.

**N6:** We started it in 2015. Our board of directors recommended that we do it because they thought it was an effective tool.

**N7:** We started the evaluation in 2013. At that time, we thought that information disclosure, public participation, and legal remedies were most useful for environmental protection. At the beginning, we didn't have a good way to promote information disclosure. We thought IPE's PITI had been successful so we decided to use their method.

**2. Did your organization have any kinds of communication with local government (EPB) before starting PITI evaluation? E.g., did you need to inform the local government (prefecture-level) or upper level government (provincial or central level) to get their approval? If yes, can you please describe the communication?**

**N1:** There was no communication before the evaluation. We think we need to be fair as a third-party. If they are told in advance, they may temporarily supplement the information, resulting in a fake score.

**N2:** We didn't need to get the approval, but they wanted us to tell them before publishing the report. They wanted to make sure the assessment results were scientific and reasonable.

**N3:** Approval was not required.

**N4:** Never had communication. We directly conducted the evaluation.

**N5:** Never had communication. We directly conducted the evaluation.

**N6:** Never had communication.

**N7:** Yes, we communicated with the provincial EPB before that, but we didn't need to get their approval. We asked their opinion on the PITI evaluation. Their attitude was that PITI is a third-party report so they have no opinion. They thought that we could publish it independently. So in the following year, we didn't communicate with them before the release.



**3. During the PITI evaluation, did your organization have any kinds of communication with local EPB (prefectural level) or upper level EPB (provincial or central level)? If yes, can you please describe the communication?**

**N1:** There was a lot of communication with them during the release of the report. We sent them an invitation to attend our conference. We also sent both the provincial and prefectural EPBs the report.

**N2:** In the release process, we sent the evaluation results to the local EPB and also sent an email to them.

**N3:** During the evaluation, we needed to communicate with them because the “Response to Public Information Requests” item requires it. During the release process, we posted the report on the WeChat. We also sent the report to the local governments.

**N4:** We directly communicated with each city about their shortcomings and the reasons for these shortcomings. We also gave them some suggestions on how to improve.

**N5:** We communicated with local, provincial, and central level government by sending them the report.

**N6:** We sent our results to them before the release. We also sent the report to each of them during the release phase. We didn’t have a high-profile launch event, worrying that they would stop us.

**N7:** We invited them to our conference and sent the PITI report to them.

**4. What was the relationship of your organization with the local and provincial EPBs before doing the PITI evaluation? What is the relationship like after the PITI evaluation?**

**N1:** The communication became more frequent. We used to have no communication with them before, except for complaints. However, after the PITI evaluation, in fact, we communicated with them quite a lot. We found they are willing to listen to our opinions. Of course, they also gave us some advice and let us know more about their work.

**N2:** The frequency of communication has been increased because there is a need for communication during the PITI evaluation.

**N3:** There is a slight change but we only need to contact the EPB if we need something to apply for or have environmental problems. Usually, the contact is not very frequent.

**N4:** Yes. After so many years of evaluation, local and provincial EPBs are now more willing to sit down to talk with us about their shortcomings and how they can improve.

**N5:** Because we only did it for one year, I haven't seen too much impact yet. We already had a lot of contacts with government before.

**N6:** With the provincial EPB, our relationship was sometimes good and sometimes bad, which was mainly related to the leader's preference. With the prefecture-level EPBs, some are good and some are bad. Some EPBs are very active, so the PITI helped us to establish very good relationship with them, but some EPBs had a lot of opinions on us and even reported us.

**N7:** PITI is a project we started very early on, so it played a very important role in establishing a better relationship with EPBs. For example, now we have the opportunity to communicate with EPBs every year regularly. In addition, as an evaluator, we have certain advantages in communicating with EPBs.

**5. Does the local EPB know that your organization is evaluating them? Do upper level EPBs know that your organization is evaluating them? Is there any evidence that they value this monitoring?**

**N1:** They all know. Local governments showed a great interest in their scores during the publicity period. For example, last year, one city was not satisfied with its score. The officials wanted us to increase the score. We did not promise them, so they finally sued us and said that the PITI score would undermine social stability. However, the provincial EPB still encourages us to conduct the PITI evaluation, so the evaluation is still ongoing this year.

**N2:** They know that because they replied to us. I don't know whether there's other specific behavior.

**N3:** Yes, they replied to us.

**N4:** I think they treat the PITI more as a tool to discover their shortcomings in information disclosure work. The specific performance is reflected in the fact that each PITI item is getting higher and higher over time. We feel that their information disclosure work is getting

better.

**N5:** They know that but specific behaviors have not been seen.

**N6:** They know it but I don't think they value PITI very much. Although information disclosure is constantly improving these years, I feel that they have not attributed it to us.

**N7:** Both local EPBs and provincial EPB know that we are doing the evaluation. Some EPBs actively interacted with us but some just ignored it. Once, a city ranked last, and the local government contacted us to ask what they could do to improve. The provincial EPB has interacted with us on the PITI evaluation.

**6. Does your organization have any other monitoring activities like PITI? If yes, what are they?**

**N1:** Yes. Since 2016, we have conducted four evaluations for administrative penalties, on-line monitoring, permits, and the EIA. There is quite large impact of these assessments. The provincial EPB even formulated two provincial-level policies and regulations caused by these assessments. In addition, we also conducted a third-party audit of the corporate credit evaluation made by the government. We found many problems and also provided feedback to the provincial government.

**N2:** No other activities yet.

**N3:** We have another activity on Weibo. We report environmental problems there.

**N4:** There is nothing else. We mainly use the PITI tool to evaluate their work.

**N5:** Yes, for example, we are doing something to urge the government to enforce the law by requests and petitions. Specifically, we have made an environmental risk map, which is mainly to assess and present the government's response to environmental complaints. It is a way to reflect the level of interaction between the public and the government.

**N6:** No other activities yet.

**N7:** We are supervising the government's law enforcement, and conducting horizontal comparisons between local EPBs.

**7. Does your organization plan to carry out any other monitoring activities in the near future? If yes, can you please describe them?**

**N1:** We may consider more activities.

**N2:** There are currently no other plans.

**N3:** No plans for now, because we mainly supervise polluting enterprises.

**N4:** For now, we will continue using the PITI as a tool because we have seen some improvements in local government in our previous work. We haven't considered other means at the government-level yet. In addition, we are going to focus on the assessment of corporate environmental information disclosure in the near future, because the ultimate goal of reducing pollution is at the firm level.

**N5:** We will continue to conduct the PITI and environmental risk map.

**N6:** Yes, we want to promote information disclosure of urban waterways in the near future.

**N7:** Now we are preparing for the county-level information disclosure project because we found that the prefecture-level EPBs have been relatively open but the county-level EPBs are still relatively lagging.

**8. Were there any activities that your organization planned to complete that have been banned by the government? If yes, can you please describe it?**

**N1:** No. PITI was not forbidden but some cities have shown some resentment.

**N2:** No.

**N3:** I have not heard of it. The attitude of the government is now relatively open. Since the environmental pressure is very large now, they are now willing to cooperate with us.

**N4:** Not yet.

**N5:** There has been once when we requested information disclosure. It was during the Two Sessions (Liang Hui), the court coordinated with us to ask us to suspend it because everything became more sensitive during the Two Sessions. However, the court also said that they would help us communicate with EPB, and finally the information was made public after the Two Sessions.

**N6:** Yes. Like PITI, they complained about us, so we didn't make the evaluation very high-profile, but we will continue to do it anyhow.

**N7:** There has been once in 2013. We planned to launch thousands of volunteers to carry out monitoring of rural drinking water. The drinking water safety issues are more sensitive

so it was canceled by the government.

**9. What responses has the local government made toward NGO's activities? Are restrictions on NGOs increasing or decreasing? Please describe.**

**N1:** As mentioned before, the provincial-level government formulated two provincial-level policies and regulations largely caused by our activity. The restrictions are getting less and less. In general, the attitude of the public security department is from limited to support and is becoming increasingly supportive. The transition probably started in 2016. We believe that all the work we do should be open and transparent, so once we have a new activity we inform the public security department in advance. Therefore, they have gradually reduced their control over us, and now there is basically no control.

**N2:** For example, we usually give suggestions regarding their work related to environmental issues, and they generally actively communicate with us. I feel that the restrictions are getting less and less, and the overall feeling is that the things we can do is becoming more and more.

**N3:** The response rate on Weibo is about 40%, and I think it is quite high. The restriction is less and less. Now, we organize a lot of salons and lectures with the EPB. In addition, when we find environmental problems, they always actively communicate with us to solve them together.

**N4:** They respond to us mainly in the form of face-to-face communication. They are willing to listen to our suggestions now. For the restriction, the overseas funding restriction is more stringent. However, there is no restriction on our specific activities. After all, the contact between government and NGOs is more and more recently, and thus the trust has gradually been established.

**N5:** Their response rate to our complaints is fine. Previously, the control was strict in our province. The communication with the government in the past two years has been becoming relatively smoother. We mainly do some work related to pollution report, information disclosure, and other socially useful activities, which do not involve too many sensitive topics.

**N6:** I feel the restrictions are more than before. For example, we need to get approval from both the EPB and the administrative department now.

**N7:** The local government gave us feedback on our supervision activities very often. We also made some suggestions on some of the government's law enforcement, policy changes, or platform optimization, and they also gave us feedback. EPBs haven't imposed any restrictions on us. The civil affairs department has expressed some opinions, but there was no real restriction.

## **J Examples of Chinese NGOs' Monitoring and Disclosure Activities**

Name of NGO(s)	Type of Monitoring	Information Disclosure
1. Shanghai Qingyue	Following the “Measures for the Evaluation of Corporate Environmental Credits”, provincial governments carry out audits of polluting enterprises compliance with environmental laws and regulations and provide the resulting information to the public and financial institutions as part of a credit audit. As a check on governments’ assessments, Shanghai Qingyue used publicly available data to verify the governments’ audit results. Shanghai Qingyue mainly reviewed the legal litigation and environmental administrative penalties in the evaluation of enterprises and checked whether all the participating enterprises in the five provinces of Zhejiang, Anhui, Hunan, Sichuan and Fujian were rated credibly by provincial governments.	Results were published on WeChat and directly sent to the provincial governments. See: <a href="https://mp.weixin.qq.com/s/iJZrfrRCj2treuEhPQKz3Q">https://mp.weixin.qq.com/s/iJZrfrRCj2treuEhPQKz3Q</a> , Accessed August 2018.
2. China Administrative Management Society and National Big Data Professional Committee	These third-party organizations use real-time information collection, website information capture, and written questionnaires to evaluate the online government service capabilities of more than 3,000 government service centers nationwide.	Public event releasing a report was held in the media building of People’s Daily newspaper. See: <a href="http://www.sohu.com/a/219096940_787041">http://www.sohu.com/a/219096940_787041</a> , Accessed August 2018.
3. Digital and Mobile Governance Lab of Fudan University	They evaluated and ranked the level of open data of 8 provincial governments and 38 prefecture governments, including the total amount, openness, coverage, and continuity of open data platforms.	Public event and publication of a report held at the Local Government Open Data and Innovative Development forum. See: <a href="https://www.sohu.com/a/233466047_204078">https://www.sohu.com/a/233466047_204078</a> , Accessed August 2018.

Name of NGO(s)	Type of Monitoring	Information Disclosure
4. China Software Testing Center	They ranked the performance of governments' websites in terms of information disclosure, government service, interactive communication, website function and influence for each province, prefecture, and county.	They invited officials from central government and local governments, scholars, and more than 50 news media to participate their release conference. See: <a href="http://www.cstc.org.cn/wzpg2016/index.html">http://www.cstc.org.cn/wzpg2016/index.html</a> , Accessed August 2018.
5. National Development and Strategy Research Institute, Renmin University of China	They provided an index of political and business relations in 285 cities in China using online public information. Specifically, they focused on two kinds of relationships: whether local governments help private enterprises when they have difficulties and whether there is corruption.	They published a report online and the report was reported on by dozens of news media outlets. See: <a href="http://nads.ruc.edu.cn/displaynews.php?id=5559">http://nads.ruc.edu.cn/displaynews.php?id=5559</a> , Accessed August 2018.
6. National Double Innovation Demonstration Base of Nanjing University, Xinhuanet Co., Ltd., and Innovation Science Research Center of Chinese Academy of Social Sciences	Starting in 2016, they evaluated the level of e-service capabilities of provincial and prefecture governments by establishing a quantitative assessment system.	Each year, they hold a release conference to publish their reports. See: <a href="http://news.nju.edu.cn/show_article_7_46490">http://news.nju.edu.cn/show_article_7_46490</a> , Accessed August 2018.



Name of NGO(s)	Type of Monitoring	Information Disclosure
7. Public Policy Research Center of Shanghai University of Finance and Economics	Beginning in 2008, they annually assess fiscal transparency through surveys of all 31 provincial governments in mainland China. The score for each government is based on the replies to all 113 questions and on the government's overall attitude towards the survey.	They hold a yearly release conference to publish the report containing the Financial Transparency Index and invite officials at provincial level governments, scholars, and the news media. In 2018, officials from the Ministry of Finance went to Shanghai University of Finance and Economics to conduct an in-depth discussion with the evaluation group on the issue of China's fiscal transparency. See: <a href="http://ippg.shufe.edu.cn/54/16/c3574a87062/page.htm">http://ippg.shufe.edu.cn/54/16/c3574a87062/page.htm</a> , Accessed August 2018 and <a href="#">Deng, Peng and Wang (2013)</a> .
8. Hills Governance Center, Tsinghua University	The Hills Governance Center at Tsinghua University developed an index to measure public-sector corruption in five major cities across China. Based on primary surveys, the index assesses public interaction with local government and measures the incidence of corruption using objective, quantitative criteria.	The result was mainly published in <a href="#">Yong and Wenhao (2012)</a> . See: <a href="https://www.csis.org/analysis/measuring-corruption-and-increasing-corruption-awareness-china">https://www.csis.org/analysis/measuring-corruption-and-increasing-corruption-awareness-china</a> , Accessed August 2018.
9. Green Zhejiang	In 2013, Green Zhejiang set up a public environmental supervision center. The public can report any environmental problems in real time through Green Zhejiang's mobile app (called Environmental Watch) and these are reported to the provincial or prefectural level EPBs. All concerns need to be addressed by governments within one week regardless of the progress, which exerts pressure on local governments, since both the upper level government and the public can see the information about responsiveness.	They publish information on the requests and responses through Weibo and WeChat. See: <a href="http://www.greenzhejiang.org/">http://www.greenzhejiang.org/</a> , Accessed August 2018 and <a href="#">Gao and Teets (forthcoming)</a> .

Name of NGO(s)	Type of Monitoring	Information Disclosure
10. Society of Entrepreneurs & Ecology, IPE, Friends of Nature, and The River Watcher	Based on the MEP's 2016 "Guide to the work of urban black and odor water remediation", the four NGOs conduct on-the-spot investigations of polluted water bodies, organize public comments on the effects of remediation, write research reports, facilitate dialogue among governments, enterprises, NGOs, and the public, and established a civil supervision mechanism for rectifying polluted water bodies to ensure that government targets for remediation can be achieved.	They encourage the public to upload pictures of bad water quality on their APP (Blue Map). See: <a href="http://www.see.org.cn/Foundation/Article/Detail/1478">http://www.see.org.cn/Foundation/Article/Detail/1478</a> , Accessed August 2018.
11. Wuhan Xingche	In 2015, Wuhan Xingche reported information on firms exceeding discharge standards based on online monitoring data from provincial government websites. Due to the disclosure of this information, the prefecture-level government of Wuhan has strengthened supervision and punishment of enterprises for the consistency of information. The disclosure of firm violation information by Wuhan Xingche has increased administrative penalties by more than 6 times.	They publish the violation information on Weibo monthly. See: <a href="http://www.cbcdgdf.org/NewsShow/4854/1269.html">http://www.cbcdgdf.org/NewsShow/4854/1269.html</a> , Accessed August 2018.
12. Center for Public Participation Studies and Supports, Peking University	Beginning in 2009, the Open Government Information Watch Alliance collected information from ministry websites about their compliance with the new Open Government Information regulations, including making requests for information from government ministries.	The OGI Watch Alliance published information on the failure of national ministries to comply with Open Government Information regulations and offered technical advice to national ministries. See <a href="#">Stromseth, Malesky and Gueorguiev (2017, 73)</a> .