Blunt Force Regulation and Bureaucratic Control: Understanding China's War on Pollution

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Forthcoming, *Governance*

Abstract

In the past decade, China has increasingly resorted to top-down, "blunt force" solutions to environmental problems; officials forcibly shutter or destroy factories to reduce pollution, at immense cost to local growth and employment. Why would a high capacity state like China resort to such a costly method of pollution control? I argue that blunt force enforcement is targeted at overcoming principal-agent problems in the bureaucracy. When institutions are too weak to hold bureaucrats accountable, political leaders increase oversight by drastically reducing the number of steps and resources required to produce a regulatory outcome—resulting in blunt force measures. I illustrate this logic through case studies from China's multi-year war on pollution. Using original data on blunt force measures, I then show how localities with lower bureaucratic compliance face greater blunt force pollution enforcement. These findings reveal that when bureaucratic accountability is weak, states pay a very high cost for cleaner air.

1. Introduction

In February 2015, the mayor of Linyi—a city in China's Shandong province—was summoned to Beijing to discuss his city's pollution crisis. Days before, environmental inspectors from Beijing had uncovered major pollution violations in 13 of Linyi's 15 biggest companies[1]. Shortly after this meeting, city leaders ordered 57 of Linyi's largest factories to stop production. At the stroke of midnight, authorities cut off electricity to an entire industrial park, even though some factories were still in the midst of production[2]. In the ensuing weeks, local authorities ordered a further 412 factories to reduce production and forcibly dismantled several smaller, older factories, costing the city 60,000 jobs. These stop production orders lasted for several months, until a looming debt crisis forced authorities to lift the production ban[3].

In this article, I argue that the measures undertaken in Linyi are characteristic of an emerging approach to regulating pollution. I call this approach "Blunt Force Regulation". Blunt force regulation has two unique features: First, the state applies crude, one-size-fits all restrictions against regulated entities—even against entities that are complying with the law. Second, the state authorizes bureaucrats to use extreme measures—such as forcibly destroying factories—to ensure that regulatory action produces immediate change. Data I have gathered indicates that between 2010 and 2015, blunt force pollution regulation was carried out in the vast majority of Chinese cities.

China's widespread use of blunt force regulation is puzzling, because it is such a costly regulatory approach. Through drastic, indiscriminate sanctions, the state cause unnecessary interruptions in productive activity, costing the economy billions of dollars in lost revenue and leading to widespread unemployment. Blunt force regulation also

violates property rights, aggravates businesses and creates a hostile environment for future regulation. Why would the Chinese government risk such concentrated economic and social disruptions just to punish polluters?

In answer to this puzzle, I argue that the primary goal of blunt force regulation is not to scare companies into respecting pollution standards, but to scare *bureaucrats* into taking action. The Chinese government struggles with serious principal-agent problems in the bureaucracy, especially in its implementation of environmental policy. Blunt force regulation solves this problem is two ways: First, by standardizing—to an extreme—the actions that bureaucrats must take against regulated entities, blunt force regulation drastically reduces bureaucratic discretion: This makes it easier for political leaders to identify and punish bureaucrats' deviations from implementation orders. Second, by reducing enforcement to a one-off, short-term intervention, blunt force regulation makes the threat of punishment more credible: It is easier for leaders to assess and punish non-compliance with short-term actions than to sustain the threat of detection in the long-term. In sum, blunt force regulation enables higher-level authorities to reassert control over the bureaucracy and, by extension, over regulated entities.

To date, studies explain the logic of blunt force regulation in terms of the outcomes produced: The state demolishes entire industrial sectors to streamline the economy, to tackle industrial overcapacity (Kostka & Hobbs 2012, Wang 2017), or to deliver blue skies for high-profile events like the 2008 Olympics (Shen & Ahlers 2019). The state also launches large-scale, indiscriminate punishments against polluters to scare them into compliance, or to quickly address major environmental problems (Yang 2017, van Rooij 2009 pp.14-16, Wang 2017 p.898). More recently, scholars have interpreted

blunt force regulation as a signaling mechanism, where local officials use high-profile enforcement campaigns to demonstrate their loyalty or increase their chances of promotion (Wang 2013, 2017).

Certainly all these processes are at work. However, none of them fully address the counterproductive side of blunt force regulation: In a bid to reduce pollution and improve air quality, the Chinese leadership has invested in a decade-long effort to build up a stable regulatory system. They have enhanced environmental laws, strengthened legal capacity to implement these laws, and engaged big data and public participation mechanisms to enhance enforcement. But how can the state convince polluters to respect pollution standards if both compliant and non-compliant entities expect to be punished? Why would factories invest in new infrastructure if they might be subjected to the next round of industrial restructuring? More broadly, if the government wants to develop stable incentives for reducing pollution, why would they revert to such heavy-handed scare tactics that undermine polluters' long-term incentives to cooperate with regulators?

I argue that enforcement takes on this counterproductive character when political leaders want to implement a policy, but lack sufficient control over the bureaucracy to effect changes on the ground. Leaders therefore resort to shortcuts that drastically reduce the number of steps and resources required to produce a regulatory outcome. These shortcuts make it easier to oversee and implement policies from afar, but inevitably result in excessive or clumsy enforcement actions (Chaudhry 1993, Lindblom 1977, Scott 1998, Van de Walle 1989, Zhou et al. 2013). In short, blunt force regulation is top-down solution to principal-agent problems in the enforcement process.

I develop this argument through a mix of qualitative and quantitative evidence.

First, I use process tracing on a case of blunt force regulation from southern China to show how the extreme measures used against polluters can not be explained in terms of punishment, deterrence, or industrial upgrading. I further reveal the role of higher-level orders in prompting local officials to decimate the polluting factories they previously protected.

I then use quantitative data to test this logic on a nationwide scale. Original data on blunt force measures, collected over 20 months of field research, indicates that between 2010 and 2015, authorities in 269 out 287 cities were ordered to forcibly reduce or halt production in dozens of highly polluting industries. Through quantitative analysis, I demonstrate that localities with lower bureaucratic policy compliance were more likely to be subjected to blunt force regulation, even when controlling for rival explanations, such as high level of pollution or industrial overcapacity.

To outsiders, Beijing's ability to command bureaucrats to close down polluters instantly and then silence opposition from workers and factory owners might suggest a strong state with immense control over the bureaucracy. This reflects China's reputation as a 'high capacity' state, capable of delivering decades of rapid economic growth. This study reveals that blunt force pollution regulation was, in fact, driven by weak state capacity and weak bureaucratic control. In so doing, this paper shows that in certain policy areas, there may be limits to China's fabled state capacity.

2. Regulation and the Principal-Agent Problem

When seeking to regulate pollution, political leaders face a principal-agent dilemma:

How can political leaders (the principal) implement policies across their territory when they lack the information or expertise to detect when local bureaucrats (the agents) have been captured by powerful local businesses? Without specialized environmental knowledge to assess the appropriateness of regulators' actions, central authorities cannot easily detect when bureaucratic discretion has crossed over into capture (Downs 1967, p.145, McCubbins and Schwartz 1984). Instead, it may take an outbreak of citizen protest or a serious regulatory crisis for central authorities to identify and punish regulatory capture.

Given this limited oversight, leaders must provide external motivations—such as rewards, or fear of sanctions—to encourage bureaucrats to enforce rules, even rules that contradict their own interests (Geddes 1994). In America, for example, local bureaucrats enforce environmental standards—even when it hurts the local economy—because they fear being discovered by federal inspectors, or being taken to the courts[4]. Over time, social norms and public surveillance have encouraged both firms and bureaucrats to comply as a matter of course (Gunningham et al. 2004).

In most developing countries, however, central governments face two additional stumbling blocks: First, central governments lack the resources to monitor local performance, increasing the chances that bureaucratic capture will go undetected (Duflo et al. 2013, Olken 2007). Moreover, even if central leaders were able to improve monitoring, they must also be able to use this information to sanction bureaucrats, otherwise the threat of detection is hollow. This leads to the second problem, that governments lack the institutions to credibly punish bureaucrats for sustained non-compliance. In small countries with small governments, central leaders may be able to

monitor and punish misdemeanors directly. However, in large states with vast bureaucracies, there are limits to leaders' capacity to process and act on the information they receive (Soifer 2008, p. 234). Other than occasional purges or high profile punishments to temporarily scare bureaucrats into compliance (Mertha 2017, Mei and Pearson 2014), leaders eventually have to delegate this oversight function.

In developed countries, leaders often delegate bureaucratic oversight to the courts. By specifying the actions expected of state official or regulated entities, and by empowering an independent judiciary to punish violations of these rules, political leaders can create a pervasive sense of monitoring and certainty of punishment, even in large states (North and Weingast 1989, McCubbins and Swartz 1984, p.166, 172).

In developing countries, however, legal institutions are often weak or compromised. Local officials can buy off the judiciary to rule in their favor, or draw on high-level political connections to protect themselves from retribution (Moustafa 2014, Stern 2013). This undermines the independent functioning of the courts, making it harder to sustain the credible threat of punishment. Lacking support from an independent judiciary, central leaders may entrust oversight to loyal officials, but this is a less credible form of punishment, resting on the vagaries of personal loyalty (Geddes 1994, Migdal 2001).

In short, in developing contexts, political leaders often lack "state infrastructural power", that is, the ability to monitor and compel local officials to consistently implement policies across a state's territory (Mann 2008). This leads to a situation where even leaders that are highly committed to enforcing pollution regulation cannot effect changes on the ground.

2.1 Infrastructural Power in China

In contrast to the scenario described above, China is often classified as a high capacity state with considerable infrastructural power (see, for example, Mann 2008). The government's success at delivering rapid growth, controlling birth rates and (more recently) its use of high tech surveillance to shape citizen behavior (Koskta 2019) all indicate a state that *is* able to "penetrate society and implement its actions across its territory" (Mann 2008, p.1).

Moreover, the Chinese government achieved these implementation successes without an independent judiciary or democratic accountability. Instead, central leaders overcame principal-agent problems by appealing to bureaucrats' material self-interests: Beijing incentivizes bureaucrats to follow orders and fulfill government functions by allowing them to keep a proportion of the revenue they raise from taxes and fees (Ang 2016). To ensure that policies *are* implemented, bureaucrats are assessed according to annual performance targets, and rewarded with promotions or bonuses for outstanding performance (Landry 2008). This combination of clear targets and predictable awards has convinced bureaucrats to report revenue and facilitate growth, rather than abusing their powers for petty corruption (Naughton 2016). Safe in the knowledge that bureaucrats would adhere to the center's key priorities, Beijing also encouraged experimentation, giving bureaucrats the discretion to adapt policies to local conditions (Heilmann and Perry 2011, pp.13-14). China's ability to deliver rapid growth despite high levels of bureaucratic discretion is why it is often labeled a "high capacity state" (Ang 2016, Edin 2003)

Yet as growth slips down the list of Beijing's priorities, and as non-revenue generating policies (such as environmental protection) come to the fore, scholars note that the system of closely aligned central-local incentives has begun to unravel (Heilmann and Melton 2013 pp.35-36). Instead of gaining cash for compliance, local officials find they have to spend their hard-won revenue to enforce policies or—in the case of pollution regulation—curb the main source of revenue: local industry. Annual performance assessments also incentivize bureaucrats to prioritize short term, countable outputs (such as revenue and GDP growth) over activities (such as pollution control) that require high up-front investments for little immediate payoff (Economy 2014, Fewsmith & Gao 2014). Despite elevating emissions reduction to a high priority target in 2006, Beijing still struggles to get cadres to respond to this target (Eaton and Kostka 2017, van Rooij et al. 2017).

In the past decade, Beijing has stepped up its environmental monitoring to detect where local officials may be under-enforcing pollution regulation. Chinese cities are now awash with air quality monitors, and major polluting facilities are required to install real time emissions monitoring systems. Beijing has also leveraged grassroots activism as a form of monitoring, encouraging NGOs and citizens to engage in petitions, protests, lobbying, and lawsuits to expose non-compliant officials (Hesengerth and Lu 2018, Mertha 2008, Teets 2018). However, recent studies find that increased monitoring has not translated into improved air quality (Seligsohn et al. 2018, Li et al. 2012). The bureaucratic discretion that once led to highly successful policy experimentation is now enabling bureaucrats to shirk central orders (Heilmann and Melton 2013), most

noticeably by investing in economic growth at the expense of the environment (Cao, Kostka and Xu 2019, Lorentzen et al. 2013, Ward et al. 2014).

China's struggle to implement pollution policies suggests that when central orders conflict with local interests, the state's sophisticated information-gathering capacities (King et al. 2013, Lorentzen 2014, Truex 2017) may not be enough to overcome bureaucratic principal-agent problems. Beyond simply identifying non-compliance, the leadership must also be able to credibly punish bureaucrats who consistently defy orders.

The regime currently relies on top-down internal party mechanisms (known as "hold-to-account" orders) where party leaders punish corruption or disobedience amongst cadres. However, two features undermine the credibility of this punishment: First, the threat is greatest when it comes directly from the leadership, but Beijing can only sustain its attention on each case for a short period. Follow-up on cadres is delegated to provincial or lower-ranked officials, leading to a more corruptible process where punished officials are often restored to their original career path a year later (Mei & Pearson 2014, p.90). Second, the use of arbitrary punishments can alienate cadres, which conflicts with Beijing's desire to maintain a stable and loyal bureaucracy (Mei & Pearson 2017, p.2). This tempers the threat coming from central authorities, which is why in democratic contexts, governments often delegate the threat of credible punishment to an independent judiciary. China began making a move in this direction with its rule of law reforms in the 2000s, but has since roll backed these reforms (Minzner 2015) signaling an entrenchment of top-down, authoritarian accountability.

Thus, the Chinese leadership's struggles with credible punishment suggest that—contrary to its image—in certain policy spheres where central and local incentives are

misaligned, the state *does* lack infrastructural power. Given this weak infrastructural capacity, how can China make bureaucrats comply with urgent environmental policies?

3. Blunt Force Regulation

I argue that states with weak infrastructural power use blunt force regulation as a top-down solution to bureaucratic non-compliance. It offers political leaders the most direct means to sidestep principal-agent problems in the bureaucracy and ensure that pollution control is enforced.

Recall the two key principal-agent problems that governments face: First, political leaders lack the expertise and monitoring capacity to verify if bureaucratic behavior has crossed from compliance into capture. I propose that blunt force regulation solves this problem through indiscriminate, one-size-fits-all sanctions. For instance, political leaders, knowing that steel industries have high emissions, might forcibly stop production in *all* steel companies in an area, even if some of these companies are complying with pollution standards. In effect, the state uses information shortcuts instead of actual evidence of violations to determine who should be sanctioned. I argue that the goal of these one-size-fits-all sanctions is to make it more straightforward for higher-level authorities to verify that local bureaucrats are acting on orders. After all, it is easier for officials in Beijing or in provincial capitals to check if municipal and county bureaucrats have forced an entire industry to stop production, than to check if they are inspecting and collecting penalties from individual factories.

The second challenge that political leaders face is the problem of credible punishment. Even if regulatory capture has been detected, central leaders will have a hard

time sustaining the threat of punishment if independent monitoring mechanisms are compromised. Again, I propose that blunt force regulation solves this problem through extreme, one-shot regulatory interventions, such as ordering local officials to forcibly shutter or relocate factories. In contrast to the ordinary regulatory actions of monitoring, fining, and negotiating with polluters—which are more opaque, and which require consistent pressure on local bureaucrats to succeed—when it comes to closing down factories, local officials only need to complete one decisive action to reduce pollution. This means that political leaders only need to inspect local bureaucrats once to ensure that the job has been done, and they only need to sustain the threat of punishment for a short period of time. In other words, the one-shot nature of blunt force regulation suddenly makes the threat of punishment credible, even from a leadership that ordinarily lacks oversight.

Blunt force regulation is suboptimal. In more advanced regulatory environments, governments only resort to such costly punitive measures after firms have repeatedly failed to comply (Ayres and Braithwaite 1992, Hawkins 1984). Governments also take pains to identify and punish individual violators, refraining from harsh, indiscriminate regulation for fear of discouraging future compliance. However, improving outcomes through routine inspections or incentive-based mechanisms require considerable administrative resources and committed (or coercible) bureaucrats—both lacking in developing countries. In contrast, blunt force regulation sidesteps these limitations by simplifying regulatory interventions to the extreme. Moreover, by temporarily enabling leaders to monitor, motivate and sanction local bureaucrats, it increases chances that regulatory outcomes will actually improve on the ground.

China represents a good case for examining the logic and effectiveness of blunt force regulation because the government's blunt force regulation of polluters represents one of the most widespread and long-lasting examples of this regulatory approach. The measures used in China were also unusually extreme. While some local authorities engaged in temporary tactics, such as 'stop production' orders, others resorted to the complete and irreversible destruction of local industry. The scale of blunt force regulation in China therefore makes large n analysis possible, while the severity of these measures makes China a good case for understanding why governments might engage in such a counterproductive approach to regulating polluters.

This paper focuses on principal-agent problems between provincial officials (the principal) and city officials (the agents) in China's environmental enforcement. City (and county) officials are responsible for implementing the majority of environmental policies, including monitoring and controlling polluters, while provincial officials are directly responsible for ensuring their compliance. Increasingly, provincial officials struggle to obtain compliance in environmental policy implementation, because city officials still gain more from favoring economic growth policies. For instance, Jiang (2018) shows that while provincial and city officials' objectives are aligned on economic and development policies, this alignment falters in non-economic policy areas (p.995).

This is not to say that central officials are excluded from efforts to bring about local bureaucratic compliance. As explained in the case study and data below, while the province often decides how and how much blunt force regulation is carried out by cities, the guiding blunt force policy (including forcibly reducing industrial production) often

originates from the Center, and is supported by central funding, with provincial officials acting as an intermediary.

In the following sections, I present quantitative and qualitative evidence on blunt force regulation in China. I draw on a case study of blunt force regulation from Guangdong province to clarify how blunt force regulation works. Building on this case study, I then turn to large-n analysis to demonstrate the connection between blunt force regulation and bureaucratic control.

4. Case Study: Blunt Force Regulation in Southern China

The city of Qingyuan in Guangdong province is located just seventy kilometers north of Guangzhou. Nestled between green hills and a wide river, Qingyuan has been dubbed the 'garden suburb' of Guangzhou. Yet for forty years, Qingyuan has also been the site of one of China's biggest e-waste and electronic recycling industries. Since the 1980s, these factories have turned imported waste into recycled copper, aluminum and plastic. Most factories are small, operating on slim profit margins and with basic technology. However, their combined production output is high; in 2013, approximately 38% of China's recycled copper and 14% of the nation's total copper production came from two of Qingyuan's counties[5].

In 2012, China's Ministries of Finance and Environmental Protection issued notices ordering all local governments to conduct an audit and clean up of e-waste industries[6]. This sounded the death knell for Qingyuan's e-waste industry. The Guangdong provincial government quickly identified Qingyuan as one of two key cities

for an "e-waste pollution rectification plan", prompting Qingyuan to launch a 2012-2020 plan to "rectify" the e-waste industry.

However, on the ground enforcement remained haphazard. Despite mounting pressure from middle class homeowners—newly arrived from Guangzhou, and outraged at the pollution happening at their doorstep—Qingyuan's local Environmental Protection Bureau (EPB) adhered to former (weaker) enforcement standards, with little visible impact on the industry[7]. In contrast, in Shantou city (which had also been targeted for major e-waste rectification in 2012) city officials shuttered 2028 e-waste factories in 2013, and subjected a further 3141 factories to direct supervision by the environmental, tax and commerce bureaus[8].

In early 2014, Qingyuan's government suddenly changed tack, cracking down on 696 small e-waste factories. These factories were forced to either close down or move into a newly established industrial park. City officials then initiated the first stage of a central government funded soil restoration project to clean up soil polluted by stockpiled e-waste. On April 16, the Provincial Vice Governor visited Qingyuan to inspect the city's progress on e-waste rectification[9]. However, enforcement returned to business as usual for the remainder of the year.

Then in early 2015, Qingyuan restarted its crackdown. City authorities (including officials from environmental and law enforcement agencies) conducted a wave of audits and inspections in all local counties. In one county, out of the 967 factories inspected, authorities determined that only 104 had proper permits, and 412 were considered to be "operating illegally" for failing to move into designated industrial parks[10]. Enforcement teams promptly ordered 1295 factories to voluntarily evacuate their premises by a set

deadline. Factories that had once been shielded from punishment were suddenly facing threats to have their electricity cut off, raw materials seized, and factory equipment destroyed[11]. In another county, local cadres and party members involved in the industry were asked to take the lead in stopping production and refrain from renting out land to "illegal" factories[12]. In total, the city shuttered 2358 factories in just a few months, impacting 29 village associations, 302 village groups and approximately 20,000 workers. In July 2016, the province again sent a supervision team to Qingyuan to inspect progress on e-waste rectification[13].

4.1 Indiscriminate and Abrupt Enforcement

Sudden enforcement campaigns and indiscriminate crackdowns are a common feature of policy implementation in China. Scholars argue that these crackdowns are used to deter widespread non-compliance in regulated entities (Biddulph et al. 2012, Liu et al. 2015 p.87, Shen and Ahlers 2019, van Rooij 2009 pp.14-16). The state engages in a wave of coordinated, sometimes extra-judicial enforcement measures to scare firms into compliance, producing what seems like a deliberate purge of small firms or dirty industries—as we see in Qingyuan.

Recently, this campaign-style enforcement against polluters has also been portrayed as a form of industrial restructuring and urban planning: As the economy grows and moves towards more service oriented sectors, local governments try to consolidate industry by moving them into industrial parks, or by forcibly eliminating some industries to accelerate the transition towards cleaner growth (Kostka and Hobbs 2012, pp.777-

778). Local officials also shut down sectors with overcapacity problems, arguing that these sectors would have dissipated "naturally" (Wang 2017, p.898).

Certainly, all these processes were at work in Qingyuan. Local authorities were trying to scare firms into compliance, to corral factories into industrial parks, and to restructure local industry. However, none of these theories fully explain two puzzling features of the crackdown: First, why were enforcement measures carried out so indiscriminately? Why did local authorities shut down compliant factories and cleaner, upgraded factories alongside non-compliers? Note, for example, that in one county in Qingyuan, while only 412 factories were deemed to be operating illegally, the total number of factories forcibly shuttered—1295 altogether—far exceeded the number of illegal factories.

The indiscriminate nature of the closures suggests that it was more than just an effort to scare polluters or corral them into industrial parks. The city government even announced openly that it was pursuing a policy of "closures first and relocations [into industrial parks] second,"[14] suggesting that relocation was not the main goal of their crackdown. Moreover, some of the companies that I interviewed in Qingyuan did not fit the description of "ailing" or "contributing to overcapacity". Instead, these firms were profitable, had consistent customers, and had installed up-to-date pollution abatement infrastructure in anticipation of the government's war on pollution. These firms also relied largely on machine technology, rather than human labor, which put them at the more advanced end of the upgrading spectrum. If industrial upgrading was the city's main goal, why were these companies also subjected to production bans for days or weeks at a time[15]?

Compare the indiscriminate actions of 2014-2015 with Qingyuan's 2011 campaign (also ordered by higher levels) to rectify factory pollution. In 2011, city officials suddenly began to inspect, discipline and sanction firms that had failed to install abatement infrastructure[16]. These actions only targeted non-compliers, and reflected the standard 'arms length' regulatory approach, where the state can sanction polluters for failing to meet established standards, but cannot forcibly stop their productive activity. In contrast, the irreversible tactics used in 2015 (including forced closures or destroying infrastructure) suggest that the government's goal was no longer to improve firm compliance, but to eliminate pollution sources altogether.

Second, why was enforcement conducted so suddenly, and in such a concentrated period? If city officials launched a plan to clean up the e-waste industry in 2012, why did they wait until 2014 and then pursue such concentrated enforcement measures against this industry? Why not enforce punishment in a more consistent manner so as to ease unemployment shocks and soften the transition for factory owners?

The abrupt, concentrated nature of enforcement—interspersed with periods of enforcement laxity—suggest that it was higher-level officials who ordered local authorities to eliminate these pollution sources as a means to overcome protracted local non-compliance.

When Qingyuan announced its e-waste rectification plans in 2012, it was in the midst of a luxury development boom. Real estate developers were flocking to Qingyuan, opening up a new stream of revenue from greener industries. This gave local officials strong incentives to close down the dirty e-waste industry. And yet, the local government continued to protect polluting industries during the height of the luxury development

boom in 2012-2014. They even angered the newly arrived middle class residents (and risked scaring off future real estate investments) by openly backtracking on their promise to punish polluters[17]. This shows just how entrenched local protectionism had become. What, then, prompted Qingyuan's government to suddenly turn against the e-waste industry after years of shielding them from punishing regulations.

It should be noted that both Qingyuan and Shantou—the two cities that the provincial government had selected for e-waste rectification—initiated sudden, blunt force closures of their e-waste industries. Both cities were then visited by the same Provincial Vice Governor shortly after these closures. Moreover, just before the second crackdown began in Qingyuan in early 2015, local authorities announced, "We are currently awaiting special funds from the central government to carry out clean up measures. Once the funds arrive, we will be able to destroy this e-waste industry."[18] In March 2015, central officials also came to Guangdong province to evaluate the province's performance on soil restoration and heavy metal pollution in former e-waste sites[19].

5. Blunt Force Regulation and Bureaucratic Control

Drawing together these case details, I propose that blunt force regulation was mandated by the provincial government to overcome bureaucratic non-compliance in Qingyuan, and to ensure that specific policy implementation outcomes were delivered: City officials undertook indiscriminate factory closures at the behest of provincial officials, who were themselves under pressure from the central government to implement a centrally-funded e-waste rectification project.

Other scholars might interpret these sudden, indiscriminate enforcement campaigns as a signaling activity initiated by city officials: As year-end performance assessments loom and city officials seek promotion, they undertake high-profile campaigns to demonstrate their loyalty to provincial officials, but then return to business as usual once a crucial assessment period passes (Wang 2013, pp. 420-422, Wang 2017, 898). This presents an alternate explanation for Qingyuan's reluctance to begin enforcement, followed by its sudden crackdowns on polluters.

However, if city officials wanted to signal loyalty, why not use the less intrusive, more reversible enforcement measures that they employed during the 2011 pollution rectification campaign, namely intensified inspections and penalties? Why go to the extent of irreversibly destroying thousands of firms, with enduring losses to the city's revenue and employment? Indeed, studies of signaling or "performative governance" (Ding 2016) indicate that local officials usually engage in very superficial, reversible activities to demonstrate loyalty, rather than actually cleaning up pollution problems.

I argue that the indiscriminate and short-term nature of blunt force enforcement can be explained as a form of bureaucratic control. Faced with years of bureaucratic evasion, higher-level officials recognize that they can only produce meaningful reductions in pollution if local officials are ordered—under immediate of threat of punishment—to undertake sudden, irreversible actions against polluters. In the Chinese context, it can also be seen as an attempt by central and provincial leaders to reassert authority in industrial sectors where it has lost control over local implementation, especially now that severe pollution has made these sectors strategically important again[20].

This argument—that blunt force regulation is used to overcome bureaucratic policy non-compliance—leads to the central hypothesis:

1) Political leaders will order local (city) officials to carry out more intensive blunt force regulation in cities with low bureaucratic compliance on environmental policies.

A rival hypothesis suggests that blunt force regulation is undertaken to address severe pollution and punish non-compliant industries. Bureaucratic compliance is less important, because the main goal is to punish polluting companies. This leads to the hypothesis:

2) Political leaders will order local (city) officials to carry out more intensive blunt force regulation in cities with high pollution levels.

Alternately, theories suggest that the provincial (and central) government uses blunt force regulation to reduce industrial overcapacity and consolidate industries into larger, more efficient facilities. From this perspective, pollution levels and bureaucratic compliance should have little bearing on blunt force regulation. Instead:

3) Political leaders will order local (city) officials to carry out more intensive blunt force regulation in cities with high levels of production in bloated industries (such as steel and coal).

Finally, blunt force regulation is depicted as an accelerated process of economic upgrading that local officials initiate independently in wealthier localities. This leads to the hypothesis:

4) Blunt force regulation will be more intensive in wealthier cities.

In the following section, I use original data on blunt force regulation to evaluate these different explanations.

6. What Drives Blunt Force Regulation?

6.1 Data

To evaluate the above hypothesis, I collected data on blunt force regulation in each of China's 283 prefectural-level cities. Given its ad hoc nature, statistics on blunt force regulation are not easy to find. Evidence tends to be anecdotal, appearing occasionally in the media as public interest stories. However, one more robust form of evidence does exist in documents from the Ministry of Industry and Information Technology (MIIT) in Beijing. Each year from 2010-2015, MIIT published a list of firms in highly polluting industries across the country that would be forced to reduce production output, with specific production cuts allotted to each firm. In some provinces, these forced production cuts could amount to a 35% reduction in industrial output in some industries[21]. Although billed as measure to "eliminate outdated industrial capacity", work reports from the Ministry of Environmental Protection (MEP) as well as interviews with national,

provincial and city level environmental officials[22] confirm that this was also a central policy aimed at reducing pollution across the country.

To identify nationwide patterns in blunt force regulation, I collected a list of all the firms across China that were targeted for forced production cuts for the years 2010-2015. I focus exclusively on the industries that contribute to air pollution. I identified the location of each firm to the city level, and then calculated the total number of firms and the total tons of industrial capacity that were targeted for forcible reduction in each city.

[Figure 1]

Figure 1 shows the spread and variation of blunt force measures across China. Descriptive statistics (see Table A1 in supplementary appendix) reveal that between 2010-2015, Beijing ordered 269 out of 283 prefecture-level cities to carry out forcible reduction in industrial capacity. Reductions were most severe in polluted provinces such as Hebei, Shandong, and Shanxi, suggesting that blunt force regulation is more extreme in more polluted areas.

This paper argues that variation in blunt force regulation across China can be explained by levels of bureaucratic policy compliance: City officials who shirk or under-implement environmental policies were ordered to undertake more blunt force regulation than city officials who *do* punish polluters. As a result, we should expect to see more severe blunt force measures in localities with low bureaucratic compliance.

6.2 Independent Variable

Bureaucratic policy compliance is distinct from *polluter* compliance, which can be measured by pollution levels, or how much a firm's polluting emissions exceed set standards. In contrast, bureaucratic compliance is difficult to measure directly with pollution levels, because local officials could be intensively monitoring and fining polluters, but unable to prevent uncooperative firms from violating emissions standards.

In recent years, IPE (a well-respected, independent NGO in China) has developed a pollution transparency index (PITI), which offers a more effective measure of *bureaucratic* policy compliance. This index calculates local officials' performance on enforcement activities that do not require firm cooperation, such as 1) monitoring polluters 2) disclosing emissions data and 3) responding to public complaints[23]—all reflecting a bureaucrat's will to enforce policies. However, less than half of all Chinese cities (113 in total) are evaluated for this index, and wealthier cities are disproportionately represented.

To sidestep this problem of incomplete data, I use "Per Capita Revenue" as a proxy for bureaucratic compliance with pollution policies. Per capita revenue is measured as "own source revenue" (that is, all taxes and fees collected and kept at the local level) scaled by a city's population[24]. My decision to use this measure is based on previous findings that per capita revenue is strongly associated with bureaucratic compliance on environmental policies. Revenue rich cities tend to perform well on monitoring and punishing polluters, while revenue poor cities perform poorly. Additional evidence shows that officials in low revenue cities are more likely to become pollution havens,

deliberately attracting investment from polluting industries to cover their revenue shortfalls (van der Kamp et al., 2017).

There are two mechanisms linking per capita revenue to bureaucratic compliance with environmental policies: First, local governments who lack revenue are less likely to invest in pollution inspections and monitoring—a resource-intensive activity. Second, revenue raised from local industry is one of the most important criteria for determining a city leader's chances of promotion (Lu and Landry 2014). As a result, city leaders who struggle to raise revenue will have strong incentives to attract 'dirty' FDI, or put the brakes on environmental regulation in order to protect polluters' tax contributions—one of their main sources of revenue. Conversely, leaders in cities with large revenue streams can afford to sacrifice polluters' tax revenue, leading to better compliance records on environmental policies.

Indeed, quantitative tests (see table 1) indicate that during 2010-2015, per capita revenue was the strongest predictor of good bureaucratic compliance on pollution policies. In contrast, the overall wealth of a city (measured as GDP per capita), pollution levels, and distance from Beijing are not associated with high levels of compliance. I therefore use Per Capita Revenue as proxy for bureaucratic policy compliance. However, I include a control for "GDP per capita (logged)" to ensure that per capita revenue is not picking up on the effect of the city's overall wealth—where high levels of economic growth could be driving blunt force regulation.

[Table 1]

6.3 Other Explanatory Variables

Some scholars predict that blunt force regulation is used by central governments to curb excessive pollution, and will therefore be directed at the most polluted cities. To test this hypothesis, I use (logged) Sulfur-dioxide levels (SO_2)—the main industrial pollutant—to measure air pollution. I use both satellite[25] and government reported data to measure SO_2 levels.

Other hypotheses predict that blunt force regulation is used by the central government to curb industrial overcapacity. To measure overcapacity, I use the ratio of Gross Industrial Output (in million RMB) to the number of industrial firms in a city ("Gross industrial output/ No. of industrial firms"). This measures the efficiency of a city's industry. Cities with a higher ratio of industrial output to number of industrial firms are expected to have less overcapacity, and will therefore be subjected to less blunt force regulation than their more inefficient counterparts. I also use "total steel output" (in million tons) to test the effect of industrial overcapacity. This is because steel companies are one of the main targets of blunt force regulation, and the most voluble rhetoric on curbing overcapacity (in both national and international media) focuses largely on steel industry.

In addition to industrial output variables, I also include measures for total GDP from the services industry ("GDP services") and revenue from the real estate industry ("Real Estate Revenue"). These variables test for the theory that blunt force regulation is undertaken to accelerate the process of industrial upgrading, especially in cities with a growing GDP income from services or real estate industries.

A definition of all variables, their data sources and the main model specifications

can be found in the supplementary appendix.

7. Findings

I use a fixed effect model to assess the effect of bureaucratic compliance on blunt force regulation. Table 2 presents the results of the model, which confirm the key prediction that blunt force regulation is associated with bureaucratic non-compliance. The coefficient for bureaucratic compliance (revenue per capita) is negative and significant in all models. In other words, cities with *lower* bureaucratic policy compliance are subjected to *more* blunt force regulation, even when controlling for levels of pollution and for economic and industrial variables.

[Table 2]

These findings challenge the conventional wisdom in three ways: First, they show that blunt force regulation is not just about curbing excess pollution or scaring polluters into future compliance. Instead, the intensity of blunt force regulation depends on a city leader's history of enforcing environmental policies: Cities with low revenue—where local leaders have less will and fewer resources to enforce environmental policies—are more likely to be subjected to blunt force regulation by higher levels. In contrast cities with higher revenue—where local leaders are more likely to comply with environmental policies—face less blunt force regulation. These results indicate that central and provincial governments *do* use blunt force regulation to overcome bureaucratic principal-agent problems in enforcement.

Second, the variables for industrial overcapacity ("Steel output" and "GIO/No of. industrial firms") are not significant. This suggests that blunt force regulation is not focused exclusively on industrial restructuring or eliminating inefficient industries. Indeed, the Ministry of Environmental Protection's major role in implementing this policy suggests that blunt force regulation is targeted at environmental policy compliance—a finding confirmed in my interviews with senior government officials.

Third, the non-significant finding for GDP per capita, GDP from services or real estate investment, shows that blunt force regulation is *not* more intense in areas that are wealthier or advancing economically. This shows that blunt force regulation is not undertaken by local governments to accelerate industrial upgrading in wealthy cities that have tired of older, dirtier industries. Rather, it is the revenue-poor, polluted cities—those with the least resources to withstand sudden unemployment or revenue losses—that are bearing the brunt of forced reductions ordered by higher-levels. This finding underscores how costly and painful blunt force regulation can be, and why cash-strapped local officials are unlikely to initiate this process independently.

8. Conclusion

Blunt force regulation is a striking phenomenon. Anyone who has witnessed the roadsides lined with empty factories, the factory owners standing amidst their dead assets, or the abrupt suspension of smokestacks, would have a hard time doubting China's commitment to its war on pollution. And yet it is also a puzzling phenomenon, because it is so clumsy, costly and counterproductive in the long term. Through drastic, one-size-fits-all sanctions, the state causes unnecessary interruptions in productive activity. As an

extremely adversarial approach, it aggravates business, undermines profits, and exacerbates tensions between state and society. Moreover, in applying sanctions so indiscriminately, blunt force regulation weakens incentives for firms to upgrade their infrastructure or comply with environmental laws in the long term. Why would governments take such great risks just to temporarily clean up the air?

In theorizing blunt force regulation as a form of bureaucratic control, this article offers an answer to this puzzle: Through evidence from China, this article shows how blunt force regulation is not intended to improve regulatory efficiency, nor to streamline the economy, but to improve policy implementation by reasserting leaders' control over the bureaucracy.

These findings contradict conventional wisdom, which portrays blunt force regulation as a shortsighted state strategy. Governments who engage in blunt force measures are criticized for entrenching economically inefficient processes (Wengle 2015 pp.123-130, Chaudhry 1993, p.258), or for prioritizing short-term, quick fix solutions over long-term behavioral changes (Dasgupta 2000). I show that blunt force regulation is not intended to be efficient or effective in the long-term. Rather, it reflects an age-old strategy of state leaders deliberately sacrificing responsive government and reasonable regulation for greater central control over the bureaucracy (Downs 1967 pp.144-15, Bardach and Kagan 1982, Lipsky 1971 pp. 395-396, Scott 1998).

However, the use of such heavy-handed, top-down methods tends to signal an inadequacy—rather than an excess—of state authority over the bureaucracy (Lindblom 1977). Ordering bureaucrats to destroy local industry in a bid to reassert control over local enforcement is hardly an advertisement for state strength. Consider China, a state

capable of delivering rapid growth, censoring the Internet, and controlling birth rates. This is a state with significant administrative capacity, autocratic power, and an increasingly sophisticated regulatory apparatus. And yet, in order to improve air quality, the government has resorted to forcibly reducing industrial output or closing down entire industries, at immense cost to local employment, revenue and growth.

China's turn to blunt force regulation therefore reveals how much routine regulatory practices and effective regulation depend on strong state infrastructural power. Without this power, states in the developing world may find that they will have to pay a very high cost for clean air.

Acknowledgements

I am grateful to two anonymous reviewers, Rhea Myerscough, and Jessica Teets for comments on this article. I also thank Matthew Amengual, Danny Choi, Cary Coglianese, Ruth Collier, Jacques deLisle, Iza Ding, Avery Goldstein, Jennifer Holdaway, Yue Hou, Rosie Hsueh, Wendy Leutert, Peter Lorentzen, Andrew Mertha, Kevin O'Brien, Mathias Poertner, Alison Post, Deborah Seligsohn, Rachel Stern, Rory Truex, Benjamin van Rooij, Steven Vogel, John Yasuda, and Boliang Zhu for valuable feedback and guidance on earlier drafts. Guo Yihua, Kang Xiaoyan, Lu Ye, and Xu Chengwu provided excellent research assistance. FORHEAD at the Chinese Academy of Sciences provided crucial institutional support during fieldwork. This research was funded by grants from the National Science Foundation (SES-1560166), the China Times Cultural Foundation, and UC Berkeley's Center for Chinese Studies and Institute for International Studies. All errors are my own.

Notes

[1] "Cong duqi dao duzheng" [From Inspecting Firms to Inspecting Governments], *China Central Television* (*CCTV*), March 1 2015.
[2] Li Jing, "60,000 jobs: the cost of one Chinese city's cleaner air," *South China Morning Post,* July 2 2015.
[3] Ibid.

[4] Interviews with US EPA Regulators, April 2018
[5] Yang Hui, "Qudi feifa chaijie zhen you name nan?" [Can a crackdown on illegal ewaste truly be this hard?], *China Environment News,* December 12 2014.
[6] Ministry of Environmental Protection, "Huanfa [2012] 110 hao" [2012 Environmental Law, no.110]
[7] *China Environment News*, December 12 2014 and 2015 Qingyuan Yearbook
[8] 2014 Guangdong Yearbook, p.190
[9] 2015 Qingyuan Yearbook, p.196
[10] "Qingyuan: Wei zhili wuran dui wuzheng qiye qiangzhi duandian chaichu shengchan shebei" [Qingyuan suspends electricity and dismantles equipment of illegal enterprises to clean up pollution], *Qingyuan Benshi Wen* [Qingyuan City News], April 25 2015.
[11]"Guangdong Qingyuan 40 nian dianzi chaijie ye zhuanxing" [Guangdong Qingyuan's 40 years old ewaste industry is transformed], *The Southern Daily*, July 26 2016.
[12] Longtang county enforcement official, as quoted in *The Southern Daily*, July 26 2016.
[13] "2020 niandi qian Qingyuan dianzi feiqi chaijie canzha jiang quanbu chuzhi" [Qingyuan's e-waste industry will be completely dealt with by the end of the 2020], *Qingyuan Daily News*, July 6 2016
[14] *Qingyuan City News*, April 25 2015
[15] Interview with factory owners, April 2016.
[16] 2011 Qingyuan Yearbook, p.148-149
[17] This refers to an event in October 2014 where the local EPB, in response to a tip-off from local homeowners, cut off electricity to factories that had been caught illegally burning waste. When 100 factory owners gathered to protest the township government, the EPB quickly backtracked on these punishments and restored electricity later that day (*China Environment News*, Dec 12 2014).
[18] Longtang county official, as quoted in *China Environment News*, Dec 12 2014
[19] 2016 Guangdong Yearbook, p.215
[20] For past versions of this, see Hsueh 2011, pp.135-137.
[21] This is the statistic for production cuts in 2012 for Hebei's cement industry. See supplementary appendix for full details on production cuts
[22] Interviews in Hebei province (June 2015), Guangdong province (January 2016), and Beijing (May 2016)
[23] See supplementary appendix for details on PITI data
[24] See supplementary appendix for definition of own source revenue
[25] Obtained from NASA's OMSO2e dataset (see supplementary appendix)

References

Ang, Y. Y. (2016). *How China escaped the poverty trap*. Cornell University Press.

Ayres I, Braithwaite J (1992) *Responsive Regulation*. Oxford University Press, New York.

Bardach, E., & Kagan, R. A. (1982). 2002. *Going by the Book: The Problem of Regulatory Unreasonableness*.

Biddulph, S., Cooney, S., & Zhu, Y. (2012). Rule of law with Chinese characteristics:

The role of campaigns in lawmaking. *Law & Policy*, *34*(4), 373-401.
Cao, X., Kostka, G., & Xu, X. (2019). Environmental political business cycles: the case of PM2. 5 air pollution in Chinese prefectures. *Environmental science & policy*, *93*, 92-100.
Chaudhry, K. A. (1993). The myths of the market and the common history of late developers. *Politics & Society*, *21*(3), 245-274.
Dasgupta, N. (2000). Environmental enforcement and small industries in India. *World Development*, *28*(5), 945-967.
Ding, Iza. (2016) *Invisible Sky, Visible State: Environmental Governance and Political Support in China*. PhD dissertation, Harvard University.
Downs, A. (1967). *Inside bureaucracy.* Waveland Press
Duflo, E., Greenstone, M., Pande, R., & Ryan, N. (2013). Truth-telling by third-party auditors and the response of polluting firms. *The Quarterly Journal of Economics*, *128*(4), 1499-1545.
Eaton, S., & Kostka, G. (2017). Central protectionism in China: The "central SOE problem" in environmental governance. *The China Quarterly*, *231*, 685-704.
Economy, E. (2014). Environmental governance in China: State control to crisis management. *Daedalus*, *143*(2), 184-197.
Edin, M. (2003). State capacity and local agent control in China. *The China Quarterly*, *173*, 35-52.
Fewsmith, J., & Gao, X. (2014). Local Governance in China: Incentives & Tensions. *Daedalus*, *143*(2), 170-183.
Geddes, B. (1994). *Politician's dilemma: building state capacity in Latin America* (No. 25). Univ of California Press.
Gunningham, N., Kagan, R. A., & Thornton, D. (2004). Social license and environmental protection: why businesses go beyond compliance. *Law & Social Inquiry*, *29*(2), 307-341.
Hawkins, K. (1984). *Environment and enforcement: Regulation and the social definition of pollution.* Oxford, Clarendon Press.
Heilmann, S., & Melton, O. (2013). The reinvention of development planning in China, 1993–2012. *Modern China*, *39*(6), 580-628.
Heilmann, S., & Perry, E. J. (Eds.). (2011). *Mao's invisible hand.* Cambridge, MA: Harvard University Asia Center.
Hensengerth, O., & Lu, Y. (2019). Emerging environmental Multi-Level Governance in China? *Public Policy and Administration*, *34*(2), 121-143.
Hsueh, R. (2011). *China's regulatory state: A new strategy for globalization*. Cornell University Press.
Jiang, J. (2018). Making bureaucracy work: Patronage networks, performance incentives, and economic development in china. *American Journal of Political Science*, *62*(4), 982-999.
King, G., Pan, J., & Roberts, M. E. (2013). How censorship in China allows government criticism but silences collective expression. *American Political Science Review*, *107*(2), 326-343.
Kostka, G. (2019). China's social credit systems and public opinion: Explaining high levels of approval. *New Media & Society*, *21*(7), 1565-1593.

Kostka, G., & Hobbs, W. (2012). Local energy efficiency policy implementation in China: Bridging the gap between national priorities and local interests. *The China Quarterly*, *211*, 765-785.
Landry, P. F. (2008). Decentralized authoritarianism in China. *New York: Cambridge University Press*, *6*, 31.
Li, W., Liu, J. and Li, D. (2012). Getting their voices heard. *Journal of Environmental Management,* 98 (2012), 65-72.
Lindblom, C. E.(1977) Politics and Markets. *New York: Basic*.
Lipsky, M. (1971). Street-level bureaucracy and the analysis of urban reform. *Urban Affairs Quarterly*, *6*(4), 391-409.
Liu, N. N., Lo, C. W. H., Zhan, X., & Wang, W. (2015). Campaign-Style Enforcement and Regulatory Compliance. *Public Administration Review*, *75*(1), 85-95.
Lorentzen, P. (2014). China's strategic censorship. *American Journal of Political Science*, *58*(2), 402-414.
Lorentzen, P., Landry, P., & Yasuda, J. (2013). Undermining authoritarian innovation. *The Journal of Politics*, *76*(1), 182-194.
Mann, M. (2008). Infrastructural power revisited. *Studies in Comparative International Development*, *43*(3-4), 355.
McCubbins, M. D., & Schwartz, T. (1984). Congressional oversight overlooked: Police patrols versus fire alarms. *American Journal of Political Science*, 165-179.
Mei, C., & Pearson, M. M. (2014). Killing a chicken to scare the monkeys? Deterrence failure and local defiance in China. *The China Journal*, (72), 75-97.
Mei, C., & Pearson, M. M. (2017). The Dilemma of "Managing for Results" in China. *Public Administration and Development*, *37*(3), 203-216.
Mertha, A. C. (2008). *China's Water Warriors: Citizen Action and Policy Change*. Ithaca, NY: Cornell University Press
Mertha, A. (2017). "Stressing Out": Cadre Calibration and Affective Proximity to the CCP in Reform-era China. *The China Quarterly*, *229*, 64-85.
Migdal, J. S. (2001). *State in society*. Cambridge University Press.
Minzner, C. (2015). China after the reform era. *Journal of Democracy*, *26*(3), 129-143
Moustafa, T. (2014). Law and courts in authoritarian regimes. *Annual Review of Law and Social Science*, *10*, 281-299.
Naughton, B. (2016). Inside and outside: The modernized hierarchy that runs China. *Journal of Comparative Economics*, *44*(2), 404-415.
North, D. C., & Weingast, B. R. (1989). Constitutions and commitment. *The journal of economic history*, *49*(4), 803-832.
Olken, B. A. (2007). Monitoring corruption: evidence from a field experiment in Indonesia. *Journal of political Economy*, *115*(2), 200-249.
Scott, J. C. (1998). *Seeing like a state*. Yale University Press.
Seligsohn, D., Liu, M., & Zhang, B. (2018). The sound of one hand clapping: transparency without accountability. *Environmental Politics*, *27*(5), 804-829.
Shen, Y., & Ahlers, A. L. (2019). Blue sky fabrication in China. *Environmental Science & Policy*, *94*, 135-142.
Soifer, H. (2008). State infrastructural power: Approaches to conceptualization and measurement. *Studies in Comparative International Development*, *43*(3-4), 231.

Stern, R. E. (2013). *Environmental litigation in China: a study in political ambivalence*. Cambridge University Press.
Teets, J. (2018). The power of policy networks in authoritarian regimes: Changing environmental policy in China. *Governance*, *31*(1), 125-141.
Truex, R. (2017). Consultative authoritarianism and its limits. *Comparative political studies*, *50*(3), 329-361.
van de Walle, N. (1989). Privatization in developing countries. *World Development*, *17*(5), 601-615.
van der Kamp, D., Lorentzen, P., & Mattingly, D. (2017). Racing to the bottom or to the top? Decentralization, revenue pressures, and governance reform in China. *World Development*, *95*, 164-176.
van Rooij, Benjamin. (2009). "The Politics of Law in China: Enforcement Campaigns in the Post-Mao PRC."
van Rooij, B. et. al (2017). Centralizing trends and pollution law enforcement in China. *The China Quarterly*, *231*, 583-606.
Wang, A. L. (2013). The search for sustainable legitimacy. *Harv. Envtl. L. Rev.*, *37*, 365.
Wang, A. L. (2017). Explaining environmental information disclosure in China. *Ecology LQ*, *44*, 865.
Ward, H., Cao, X., & Mukherjee, B. (2014). State capacity and the environmental investment gap in authoritarian states. *Comparative Political Studies*, *47*(3), 309-343.
Wengle, S. A. (2015). *Post-Soviet Power*. Cambridge University Press.
Yang, D. L. (2017). China's Illiberal Regulatory State in Comparative Perspective. *Chinese Political Science Review*, *2*(1), 114-133.
Zhou, X., Lian, H., Ortolano, L., & Ye, Y. (2013). A behavioral model of "muddling through" in the Chinese bureaucracy. *The China Journal*, (70), 120-147.

Tables and Figures

Figure 1: Map Showing Variation in Forced Industrial Reductions

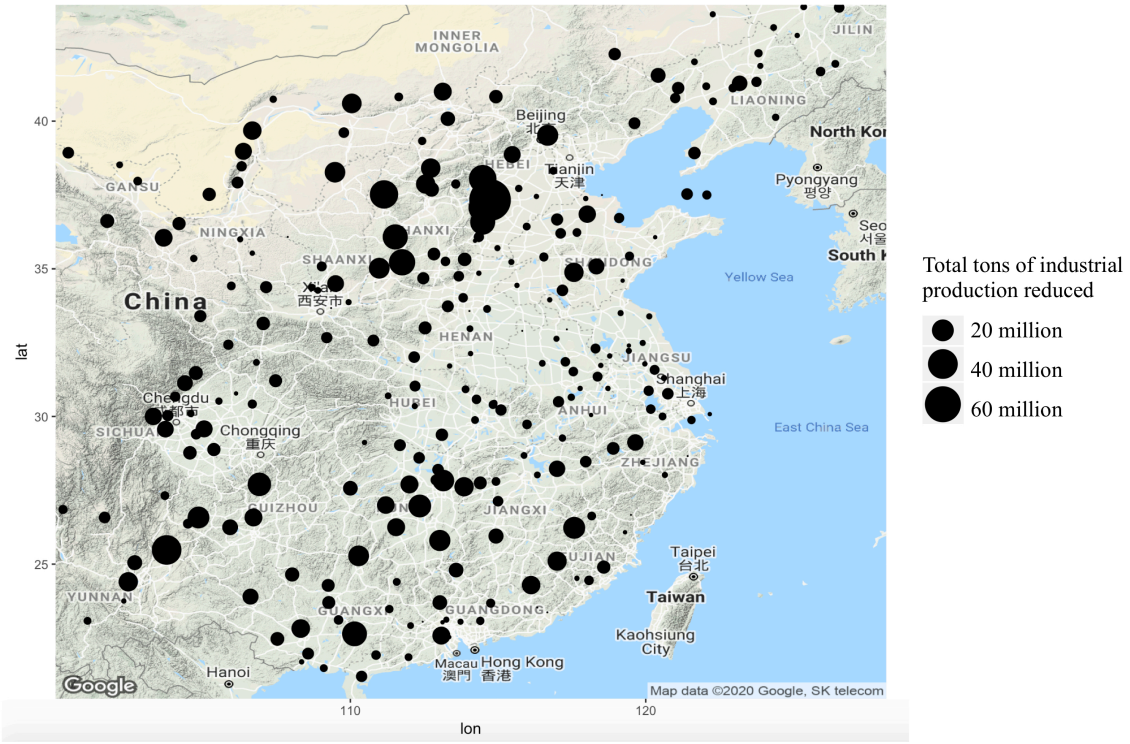

Table 1: Effect of Per Capita Revenue on Bureaucratic Environmental Compliance (Pollution Transparency)

	Pollution Transparency (PITI) Score (/100)		
	(1)	(2)	(3)
Revenue per capita	20.869*** (4.116)	12.745** (6.297)	9.624*** (1.395)
SO_2 air pollution level	1.935 (1.800)	1.791 (1.800)	-2.537 (1.482)
GDP per capita		16.291* (9.058)	
Distance (km) from Beijing			-0.789 (2.161)
Observations	539	539	562
Number of cities	109	109	117
City fixed effects	Yes	Yes	Yes
Lagged dependent variable included	Yes	Yes	Yes
Rsquared	0.311	0.317	0.101

[a.] Robust standard errors, clustered by provinces, are in parentheses. *p<0.1; **p<0.05; ***p<0.01. The dependent variable is the score out of 100 on the Pollution Transparency Index (PITI).
[b.] All independent variables are logged
[c.] Column 1 and 2 show results for fixed effects models. Column 3 shows results for random effects models.

Table 2: Effect of Bureaucratic Non-Compliance on Blunt Force Regulation

	Blunt Force Regulation (Million tons reduced—logged)		
	(1)	(2)	(3)
Revenue per capita	-0.899**	-0.948**	-0.951**
	(0.430)	(0.479)	(0.478)
SO_2 air pollution level	-0.004	-0.023	-0.022
	(0.202)	(0.200)	(0.201)
GDP per capita		0.771	0.390
		(0.987)	(0.919)
Gross industrial output/ no. of industrial firms		-0.545	
		(0.364)	
GDP from services		-1.434	-1.354
		(1.414)	(1.415)
Real estate investment		0.160	0.196
		(0.245)	(0.240)
Steel output			6.792
			(4.251)
Observations	1396	1391	1391
Number of cities	282	282	282
City fixed effects	Yes	Yes	Yes
Province*Year fixed effects	Yes	Yes	Yes
Lagged dependent variable included	Yes	Yes	Yes
Rsquared	0.159	0.158	0.157

[a.] Robust standard errors, clustered by provinces, are in parentheses. *p<0.1; **p<0.05; ***p<0.01. The dependent variable is the (logged) annual total (in millions tons) of industrial production that Beijing has ordered a city to reduce.

[b.] The dependent variable is measured for the years 2010-2014, whereas the independent variables are measured for the years 2009-2013.

[c.] All independent variables are logged

SUPPLEMENTARY APPENDIX

DATA NOTES

1. Dataset on Blunt Force Regulation

This dataset of blunt force regulation in each of China's 283 prefectural-level cities is put together using information from the Ministry of Industry and Information Technology (MIIT). Between 2010 and 2015, the MIIT issued targets for forced reductions in industrial output in 18 industries chosen for their high air and water pollution. Firms may be forced to reduce as little as 1,000 tons a year or as much as 6.1 million tons a year, but the combined impact on a region's industrial output can be significant. In Hebei province, for example, these orders amounted to a 13% forced reduction in steel capacity in 2011, followed by a 35% forced reduction in cement capacity in 2012[1]. Each year, MIIT publishes the list of polluting firms that will be forced to reduce production output, with specific production cuts allotted to each firm.

Although billed as measure to "eliminate outdated industrial capacity", work reports from the Ministry of Environmental Protection (MEP) as well as interviews with national, provincial and city level environmental officials confirm that this was also a central policy aimed at reducing pollution across the country.

Overall targets for production cuts are set by Beijing, but provincial governments take the lead in dividing and assigning targets down to the city and county level. Central government leaders do not give specific instructions on how provinces should carry out these capacity reductions orders, nor require that they focus on non-compliant firms,[2] but they do require local governments to meet these pre-determined targets by the end of the year. Provincial officials must also submit the final list of companies to be targeted for Central ministries to review and approve. This process highlights how deeply the central government is involved in blunt force regulation.

2. Table 2: Effect of Per Capita Revenue on Bureaucratic Environmental Compliance (Pollution Transparency)

Transparency Data

Data assessing the transparency scores of different cities is obtained from the Institute of Public and Environmental Affairs (IPE), a well-respected environmental NGO in China that produces the PITI scores. This NGO evaluates the implementation of pollution transparency in 113 cities. Values range from 0 (poor transparency) to 100 (excellent transparency) and include criteria such as local officials' performance on 1) complying with daily emissions standards 2) monitoring polluters 3) disclosing data on emissions levels and 4) responding to public petitions on pollution.

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[1] These statistics are calculated from data I collected on production cuts across China

[2] Interview with provincial official at the NDRC, May 2015. See also State Council, October 6, 2013 See http://www.gov.cn/zwgk/2013-10/15/content_2507143.htm

3. Table 3: Effect of Bureaucratic Non-Compliance on Blunt Force Regulation

Model Specifications

The dependent variable ("Blunt Force Regulation (logged") is measured for the years 2010-2014, whereas the independent variables are measured for the years 2009-2013. I lag the independent variables because blunt force orders are issued at the beginning of the year, so the decision for how much production each city will be forced to reduce depends on the previous year's performance.

This model uses city-level fixed effects. I also include province-year fixed effects to account for province-wide common shocks, and because provinces are responsible for allocating and enacting enforcement targets. Finally, I control for the impact of blunt force regulation in the previous year by including blunt force outcome for t-1, t-2, t-3 and t-4 in the model.

4. A note on the use of Sulfur-dioxide as a measure of industrial pollution

I focus on sulfur-dioxide (SO_2) as a measure of air pollution for two reasons. First, SO_2 is produced is the best measure of industrial air pollution, whereas other airborne pollutants (such as PM2.5 and NOx) are also produced by car and ship exhaust. Second, SO_2 is not prone to secondary chemical reactions in the air, so the amount of SO_2 in the atmosphere is a direct product of industrial emissions. PM2.5, however, is often produced by secondary reactions in the air. This means that the levels of SO_2 in the atmosphere have a more direct relationship to industrial pollution than either PM2.5 or NOx. This decision is based on advice from atmospheric science experts at Tsinghua University and information on atmospheric pollution in *Clearer Skies Over China.*[3]

5. A note on the use of SO_2 remote sensing data

Estimates of ground-level SO_2 from satellite data can now be pinned down to an area of approximately 27 by 27 km^2 at the equator, approximately the area of a Chinese city and its surrounding counties. Given that city officials usually have direct authority of large factories in surrounding counties, it is useful to include SO_2 levels from these areas.

SO_2 emissions are measured in Dobson Units (DU). 1 DU is equal to 2.69·1026 molec·km−2. Scientifically, this means "if you were to compress all of the sulfur dioxide in a column of the atmosphere into a flat layer at standard temperature and pressure (0^o C and 1013.25 hPa), one Dobson Unit would be 0.01 millimeters thick and would contain 0.0285 grams of SO_2 per square meter." (See NASA, https://so2.gsfc.nasa.gov/so2intro.html). To put this in context: Zibo city (Shandong province), one of the most polluted cities in China, recorded a mean SO_2 level of 48.140 DU in 2010-2012 for the summer months of May to September. Lincang (Yunnan province) one of the least polluted cities in China, recorded a mean SO_2 level of 1.598 DU from for same period.

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[3] See Nielsen, C. P., & Ho, M. S. (2013). *Clearer skies over China: Reconciling air quality, climate, and economic goals*. The MIT Press.

TABLES

Table A1: Descriptive Statistics of Forced Industrial Reductions
(Unit=10,0000 tons)

Year	Mean	Median	Min	Max	Total Tons (Million tons)	No. of Cities with Cuts
2010	61.34	19.25	0.36	1393.00	167.83	189
2011	90.17	28.80	0.10	3565.00	249.07	217
2012	125.0	46.8	0.20	1837.00	346.86	215
2013	48.36	10.00	0.50	1446.00	133.26	168
2014	70.36	2.70	0.20	2740.00	200.13	156
2015	68.69	40.00	0.50	443.00	65.94	96
				Total	1,163.09	269

Table 1 shows that between 2010-2015, blunt force regulation took place in the vast majority (269 out of 283) prefectural-level cities. The 14 cities with zero production cuts tend to be either very wealthy (such as Shenzhen) or small towns in remote areas (Karamay in Xinjiang).

List of Interviews

Date	Location (Province)	Administrative Level	Interviewee Position
June 2015	Hebei	County	Environmental enforcement officer
June 2015	Hebei	County	Government official (administration)
August 2015	Hebei	Provincial	Government official (environment)
August 2015	Hebei	Provincial	Government official (environment)
January 2016	Guangdong	Provincial	Government official (environment)
January 2016	Guangdong	City	Government official (environment)
April 2016	Guangdong	County	Factory owners (multiple)
April 2016	Guangdong	City	Entrepreneur/ Environmental Consultant
May 2016	Beijing	National	Government official (environment)
April 2018	Philadelphia	State-level	EPA regulator

Definition of Variables

Variable	Definition
Blunt force Regulation	The annual total tons of industrial production ordered by Beijing to be reduced in each city, for 2010-2014. This variable reflects orders for capacity reduction in industries that contribute to air pollution only. It does not include tons of production reduced through market slowdowns, or individual firm decisions. This data was hand collected using documents from the Ministries of Environmental Protection and MIIT
Revenue Per Capita	This is the annual ratio of own source revenue (i.e. the sum of all taxes and fees collected and kept at the local level) to a city's population. Revenue is measured in RMB (millions). I focus on own source revenue because in countries—such as China—where fiscal transfers to cover budget shortfalls are politicized, own source revenue is the best measure of a local government's revenue autonomy.[4] The ratio of own source revenue to a city's population therefore captures how effectively a city can cover its own budgets, or how desperately local officials need to raise additional revenue.
SO_2 Air Pollution Level	I use satellite measures of ground-level SO_2 to calculate SO_2 air pollution levels. Data is obtained from NASA's OMSO2e dataset[5]. On advice from experts, I use the Fioletov et al. (2011) method for calculating SO_2 atmospheric levels, which includes averaging only for the summer months of May-September (when there is no snow coverage). Given that central and provincial officials may also lack accurate data on air pollution when making decisions, I run the same tests with government reported levels of SO_2, obtained from the China Environment Yearbook. The results are the same for both satellite and government-derived measures
GDP services*	The total annual GDP (RMB billions) from services industries
Real estate investment*	The total revenue (in RMB millions) that a city obtains from the real estate industry
Gross Industrial Output/ no. of industrial firms*	Annual gross industrial output (in RMB millions) for each city scaled by the number of industrial firms for each city
Steel Output*	Annual steel production (in million tons) for each city. Data on steel output is only available at the provincial level. Given that variation in policy enforcement actions cluster at the provincial-level, I impute this data to the city level.

*Data for these variables were obtained from the China yearbooks dataset

[4] See Rodden, J. (2004). Comparative federalism and decentralization: On meaning and measurement. *Comparative politics*, 481-500.

[5] See Nickolay A. Krotkov, Can Li, and Peter Leonard (2015), OMI/Aura Sulfur Dioxide (SO2) Total Column L3 1 day Best Pixel in 0.25 degree x 0.25 degree V3, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC)