RESEARCH SUMMARY

Watering Down Environmental Regulation in China

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KEY TAKEAWAYS

1. After growing social unrest to improve China's worsening pollution, the central government began aggressive reforms starting in 2003. Included in this era of reforms was a target-based system to improve water quality. The central government installed several hundred state-controlled water monitoring stations along the major national river trunks and used the water quality readings to help determine the promotion of local government officials.

2. Water monitoring stations can only capture emissions from upstream, giving local officials the incentive to enforce tighter regulations on polluters immediately upstream of stations, while shirking on their responsibility to reduce pollution coming from their downstream counterparts. The researchers used this spatial disparity to quantify the effects of environmental regulation on the country's entire manufacturing sector.

3. The study found that local officials more heavily enforced regulations on polluting firms that were monitored, with firms located immediately upstream of a station being 24 percent less productive and emitting significantly less pollution than their downstream counterparts. The productivity loss was mainly driven by upstream polluters investing more in abatement equipment to meet tighter regulations. The upstream-downstream gap in productivity existed only in polluting industries and did not emerge until the central government started to link water quality readings to political promotions.

4. These estimates suggest that environmental regulation led to significant economic costs for China. A 10 percent reduction in pollution led to a 3 percent drop in productivity for China's polluting industries. Taken together, China's efforts in reducing water pollution led to a total loss in industrial output of more than 800 billion Chinese yuan over the eight years studied.

5. Further, the study found that the higher the political incentive to local officials and the more difficult it was for them to manipulate the monitor readings directly, the more significant the gap in productivity between upstream and downstream firms.

6. The study provides a timely assessment of the central government's efforts in leveraging high-powered political incentives to fight pollution. It demonstrates a clear misalignment between the national policy goal and local bureaucratic incentives as local leaders prioritized "water quality readings" over "actual water quality," as the well-intentioned policy had aimed.

Introduction

In developing countries such as China and India, billions of people live under extreme pollution every day, while still being economically dependent on dirty manufacturing industries. As these countries balance economic growth with environmental quality, it is important to understand the economic costs of alleviating pollution. However, most research studying this challenge has taken place in developed countries like the United States where the costs, political institutions and bureaucratic incentives might differ widely. This study fills an important gap in knowledge by studying China, currently the world's largest emitter and manufacturer.

In the late 1990s, after nearly two decades of unprecedented growth in industrial manufacturing, China started to face a variety of pressing environmental challenges, including deteriorating surface water quality. According to the World Bank (2007), in 2000, roughly 70 percent of China's rivers contained water deemed unsafe for human consumption.

Seeing the growing social unrest associated with surface water pollution, the Chinese central government began attempts to protect water bodies. They installed several hundred state-controlled water monitoring stations along the major national river trunks. Used mainly for scientific study at first, the effort hit full steam much later when, in 2002, Hu Jintao took over the presidency. In 2003, Hu formally proposed the Scientific Outlook of Development (SOD), which sought integrated sets of solutions to economic, environmental, and social problems, starting an era of aggressive environmental regulation in China.

Following the Scientific Outlook of Development agenda, the Ministry of Environmental Protection imposed explicit water quality targets for all the state-controlled monitoring stations, automated the monitoring stations along the large rivers and lakes to improve data quality, and began to publicize water quality readings in order to engage the public. The central government also adopted a target-based abatement system in which local politicians were promised the chance at promotion only if their targets were met. Under the local officials' efforts to regulate polluting firms and abate water pollution, China's surface water quality improved dramatically after 2003.

However, this political contract between central and local governments is undermined because of imperfect monitoring. Water monitoring stations can only capture emissions from upstream, which gives local officials the incentive to enforce tighter regulations on polluters immediately upstream of monitoring stations, as compared with their immediately downstream counterparts.

Research Design

Using this imperfect water monitoring system and the unequal targeting of regulated industries based on their location relative to the monitors, the authors conduct a natural experiment whereby they compare the productivity and pollution reductions for industries just upstream versus those located just downstream from the monitor. The key assumption of the research design is that immediate upstream and downstream firms relative to the monitoring station should be identical before the regulations are implemented (i.e. before 2003), but will differ from each other later as upstream firms face tighter regulation. Because the water monitoring stations were located based on hydrological factors before water quality readings became a political priority, this assumption seems likely.

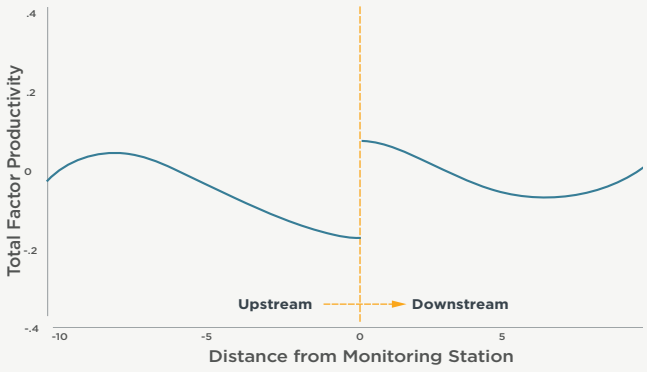
To gather the data for analysis, the researchers use the China Environmental Quality Statistical Yearbooks for information on water quality monitoring stations. Then, they collect the firm-level production information from the Annual Survey of Industrial Firms (ASIF) and firm-level emission data from the Environmental Survey and Reporting (ESR) database throughout the period 2000 – 2007. The studied sample comprises 17,726 unique ASIF firms and 9,797 ESR firms locating alongside 159 monitoring stations. After collecting the data, the researchers calculate the distance to the nearest station and project the firms to the nearest river basin to estimate their elevation which is used to differentiate whether the firms belong to 'upstream' or 'downstream' relative to the monitoring station.

Findings

Local officials more heavily enforce regulations on polluting firms that are monitored, while not enforcing regulations on firms not being monitored, causing monitored firms to be less productive. The researchers find that polluting firms located immediately upstream are 24 percent less productive. The productivity loss is mainly driven by upstream polluters investing more in (nonproductive) abatement equipment and making costly adjustments to clean up production processes to cope with tighter regulation. The gap observed between upstream and downstream firms cannot be explained by the endogenous locations of monitoring stations or polluting firms. Instead, the upstream-downstream gap in productivity existed only in polluting industries. Further, only polluters within a few kilometers upstream are regulated, as emissions from farther upstream would dissipate quickly over space and have negligible effect on water quality readings.

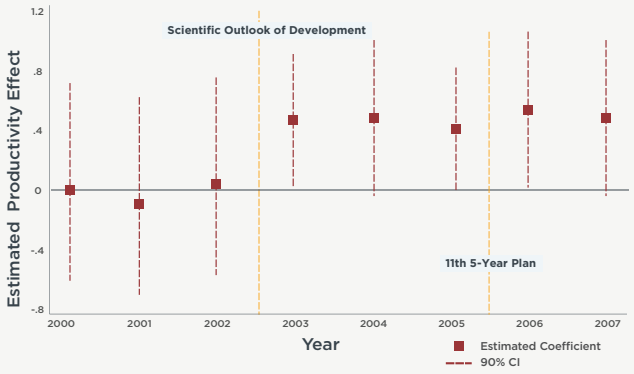
Additionally, the monitoring data shows that polluting upstream industries generate significantly lower chemical oxygen demand (COD) emissions than their downstream counterparts. In addition, even though upstream firms emit less, they pay higher amounts of emission fees than downstream firms, implying that local officials hold double standards in regulation enforcement.

Figure 1 · Productivity in Polluting Industries



When the central government started to link water quality readings to political promotions in 2003, the productivity of monitored firms dropped significantly compared to years immediately prior. The researchers find that upstream firms were just as productive as downstream firms from 2000 to 2002. When the government began to link water quality readings to political promotions in 2003, the productivity of upstream firms dropped significantly.

Figure 2 · Monitoring's Effect on Productivity



The environmental regulations led to significant economic losses to China. As the more heavily regulated firms inject more money into cleaner equipment and other abatement actions, these capital inputs do not increase their output. As a result, a 10 percent reduction in pollution leads to a 3 percent drop in productivity for China's polluting industries. Taken together, this means that China's efforts in reducing water pollution led to a total loss in industrial output of more than 800 billion Chinese yuan between 2000 and 2007, or more than 110 billion Chinese yuan per year.

The higher the political incentive to local officials, the more significant the gap in productivity between upstream and downstream firms. In China, prefecture-level leaders cannot get promoted to the provincial level once they exceed 57 years old. Using this policy to separate leaders who have a strong political incentive to meet the targets as compared to those who are less incentivized. The researchers discovered that there was an even larger gap in the productivity of upstream and downstream firms in the prefectures where the local leaders were 56 years old or younger.

> "While the policies are well intentioned, leveraging high-powered incentives creates a mismatch in goals that ultimately causes the system to be inefficient."
>
> **GUOJUN HE, DIRECTOR OF RESEARCH, EPIC-CHINA; PROFESSOR, HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY**

The gap in productivity between upstream and downstream firms is largest when it is more difficult for local officials to manipulate the data. The gap in productivity between upstream and downstream firms gets particularly large when monitoring stations are "automated"—the data is fed directly to the central government, and therefore less susceptible to direct data manipulation. This suggests that local officials used to manipulate water quality readings for those traditional "manual" stations, instead of actually regulating upstream polluters.

> "By heavily regulating some firms and not regulating others, local leaders have made the needed water quality regulations more expensive to implement, given that firms typically have increasing marginal cost of abatement."
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> **SHAODA WANG, POSTDOCTORAL SCHOLAR, EPIC; INCOMING ASSISTANT PROFESSOR, THE UNIVERSITY OF CHICAGO**

Policy Implications

The study demonstrates a flaw in the political centralization of decentralized policies. Under political centralization, when the central government wants to mobilize local governments to implement decentralized policies, it often adopts a target-based incentive scheme where political rewards are promised contingent on meeting certain performance criteria. However, if the central government is unable to perfectly monitor all aspects of decentralized program enforcement, local government officials will focus on only the aspects the central government can monitor while shirking on the rest.

In the context of improving water quality, the central government leveraged high-powered political incentives to improve surface water quality, but could only observe water quality readings of the state-controlled monitoring stations, which reflect emissions from their upstream but not their downstream. Local government officials in turn ensure the information the central government receives meets the targets by imposing significantly tighter regulation on upstream firms—prioritizing "water quality readings" over "actual water quality." As a result, the water being monitored became cleaner, while a whole host of firms escaped regulation altogether. A well-intended central program deviated from its original intent under decentralized enforcement. This example offers lessons on how the centralized government can rethink its incentive and target-based enforcement structure for decentralized policies.

The Energy Policy Institute at the University of Chicago (EPIC) is confronting the global energy challenge by working to ensure that energy markets provide access to reliable, affordable energy, while limiting environmental and social damages. We do this using a unique interdisciplinary approach that translates robust, data-driven research into real-world impacts through strategic outreach and training for the next generation of global energy leaders.