

Researcher

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Environmental Regulations in China and Their Effects on Air Pollution and Infant Mortality

This study quantifies the impact of air pollution and related regulations on infant mortality in China. To establish causality, I exploit plausibly exogenous variations in air quality generated by environmental regulations since 1995. These legislations imposed stringent regulations on pollutant emissions from power plants. The results suggest that the regulations led to significant reductions in air pollution and infant mortality rate (IMR). I estimate that 25,400 fewer infants died per year than would have died in the absence of the regulations, corresponding to a 21 percent decline in IMR. The findings also reveal that infants from low socioeconomic families are more vulnerable to the effects of pollution. More importantly, the analysis highlights the important role of maternal exposure to pollution on fetal development. The instrumental variable estimates indicate that a 1 percent reduction in total suspended particulates (TSP) results in a 0.95 percent reduction in IMR, whereas a 1 percent reduction in sulfur dioxide results in a 0.82 percent reduction in IMR. The estimated impact of a unit change in TSP is of similar magnitude to that found in the United States, but the elasticity is substantially higher in China, highlighting the greater benefits associated with more stringent regulations when pollution is already quite severe.

Country where the research will take place

China

How does the research describe the impact of population/reproductive health on poverty reduction and/or economic growth?

This study examines three major questions:

1. At greater concentration levels, how severe are the effects of air pollution on human health? Evidence of the link between pollution and health damages has been mainly focused on the United States or other developed countries, where pollution is relatively low.
2. To what extent do environmental regulations in developing countries bring forth reductions in air pollution and infant mortality? Air pollution is one of the major causes of deaths in developing countries. However, environmental regulations are still extremely contentious, as evidenced at the 2009 United Nations Climate Change Conference (also known as COP15) in Copenhagen. The debates between developed and developing countries illuminated a clear gap in priorities regarding environment, health, and economic growth. Led by China, many developing countries emphasized growth and expressed concern that environmental protections may retard economic growth. Supporters of this argument often appeal to the lack of convincing quantitative evidence relating

environmental regulation to human health in developing countries.

3. To what extent are health shocks mitigated by socioeconomic status? Infants in poor countries are considered to be the most susceptible to the effect of pollution, not only because of high pollution levels, but also because of limited resources or knowledge to avoid it.

How will the research address a policy need, and what kind of policy lesson is expected?

This study will examine the tradeoffs between environment, health, and economic growth. Since China is one of the first developing countries who implemented such a large-scale regulation on pollutant emissions from industry, the current study will shed important light on the benefits in terms of reduced infant mortality associated with reductions in air pollution.

Methods used

To assess the causal relationship, I exploit exogenous changes in air quality generated by environmental regulations. In 1995, the Chinese government amended its Air Pollution Prevention and Control Law, followed by the implementation of the Two Control Zone (TCZ) policy in 1998. The policy designates nearly 200 prefectures exceeding the nationally mandated standards as TCZ, where more stringent regulations are imposed on the power industry, which accounts for more than 90 percent of pollution. This pro-

vides a quasi-experimental setting, where the intensity of exposure to regulations can be defined by the TCZ designation, and I am able to compare changes in IMR before and after the policy reform, between the localities assigned and not assigned as a TCZ.

Data used

I compiled two major data sources: IMR data come from the Chinese Disease Surveillance Points system, a collection of the censuses of birth and death registrations for 145 nationally representative sites from 1991 to 2000; and air pollution data come from the China Environment Yearbooks, which report the annual average concentration levels of sulfur dioxide (SO₂) and total suspended particulates for major prefectures.

Research results

Overall, the findings show that the regulations led to significant reductions in air pollution and infant mortality. The estimates suggest that the regulations resulted in 53 ug/m³ declines (a 17 percent reduction) in TSP and 20 ug/m³ reductions (a 21 percent reduction) in SO₂. In addition, the regulations are found to have led to 3.33 fewer infant deaths per 1,000 live births, corresponding to a 21 percent reduction in IMR. This implies that 25,400 infant lives per year were saved by the regulations. More importantly, 61 percent of the reduction in infant mortality accrues to deaths within

one month after birth, highlighting the important role of maternal exposure on fetal development.

The study also reveals heterogeneity in the effects: Infants from low socioeconomic families show greater reductions in IMR, and infants with low birth weight benefit more from the reduction in pollution. Furthermore, exogenous variations in air pollution induced by the regulations enabled me to use the instrumental variable (IV) strategy and quantify the effects of air pollution on IMR. Results suggest that a 1 ug/m³ reduction in TSP leads to 0.049 fewer infant deaths per 1,000 live births, and a 1 ug/m³ reduction in SO₂ leads to 0.14 fewer infant deaths per 1,000 live births. The corresponding elasticities of IMR with respect to pollution concentrations imply that a 1 percent reduction in TSP (SO₂) leads to a 0.95 (0.82) percent reduction in IMR.

Research products

The current draft was presented at the Northeast Universities Development Consortium (NEUDC) Conference at Massachusetts Institute of Technology in November 2010. It was also presented at the Institute for Economic Development seminar at Boston University in November 2010.

Notes

This project is in its first year of funding.