

Why is pollution from U.S. manufacturing declining?

Summary of research by Joseph S. Shapiro and Reed Walker

Manufacturing Pollution Has Declined

Air pollution from U.S. manufacturing has declined significantly since 1990. Between 1990 and 2008, the industry's air pollution decreased by sixty percent. Emission levels of regulated air pollutants, like nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds, fell by an average of 35%. This reduction was not caused by a decline in the size or productivity of the manufacturing sector itself; in this same time period, there was a substantial increase in manufacturing output, with the value of manufacturing output growing by one third. This study, by Joseph Shapiro and O-Lab affiliate Reed Walker, examines the cause of this decrease in pollution and finds that it can be traced to changes in environmental regulation of pollution.

Possible Explanations for Pollution Decline

There are three possible explanations for the decreasing pollution levels:

- First, overall productivity improvements may drive pollution reductions; as firms use fewer inputs to produce the same level of output, overall emissions could fall.
- Second, if manufacturing shifted over time to products that are less pollution-intensive, the pollution impact of the industry might decrease. This could happen, for example, due to changes in importing and exporting of manufactured goods. Some industries, like steel and cement, are higher polluters. If these products were increasingly manufactured abroad rather than domestically, the pollution impact of U.S. manufacturing could decrease.
- Third, if manufacturing changed its production methods to emit less pollution for each product manufactured, these changes would lead to an overall pollution reduction. For example, regulation-induced pollution abatement technology could reduce the pollution impact of each manufacturing process.

What Caused Air Quality Improvement

In this study, the researchers used data from the Census of Manufacturing and the Annual Survey of Manufacturers to examine manufacturing output by plant, product, and year between 1990 and 2008. They then combined this with data on pollution from the EPA National Emissions Inventory and Census of Manufacturing. These data allow the researchers to break the overall change in emissions down into the three categories: change in scale, change in composition of production, and change in production technique. They also developed a quantitative model for firms' decision-making about pollution output; combining this with the historical data allowed the researchers to explore various historical counterfactuals and explanatory channels.

Changing Emissions Were Primarily Caused by Changes in Environmental Regulation

Examining historical data on pollution and production shows that changes in the scale and composition of production did not cause most of the reduction in pollution emissions. The overall composition of the U.S. manufacturing industry has not moved significantly in the direction of cleaner types of products. Instead, changes in technique--changes in the pollution levels associated with specific products--were responsible for the decline in pollution. If these reductions had not occurred, emissions would in fact have risen by 20 to 30 percent.

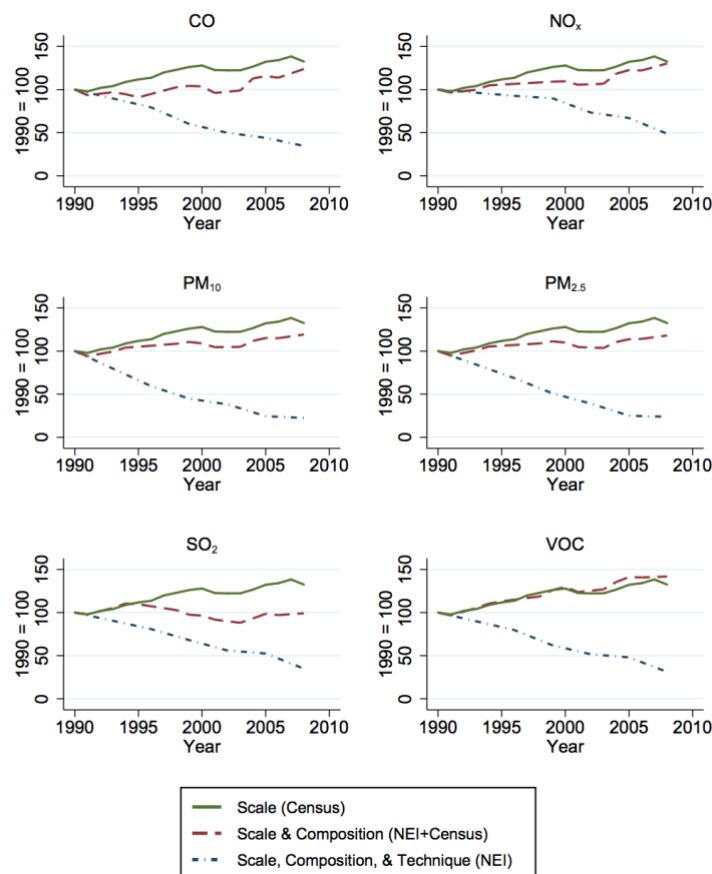
Several economic forces could have caused these product-level improvements in emissions intensity. For example, changes in trade costs could have led industry to shift toward more productive firms, which also have lower emissions intensities. Alternatively, more strict environmental regulations could have caused the reductions. To explore these explanations and determine the underlying cause of the reductions, the researchers

constructed several counterfactuals to isolate the effects of specific political and economic changes on manufacturing pollution over this period.

First, they examined the effect of foreign competition and found that it did not contribute to the emissions reductions. In fact, if all other factors besides foreign competition had remained unchanged, there would have been a small increase in pollution rather than a decrease. Part of the reason import competition did not explain emissions improvements is because imports are not concentrated in high-pollution industries.

The only factor that was ultimately found to reduce emissions over this period was a change in environmental regulation. In the early 1990s, environmental regulation accounted for 90% of the observed pollution reductions, and by 2008, it accounted for virtually all of the reduction.

Figure 1: Manufacturing Emissions Decomposition



Policy Implications

This work shows that environmental regulations, such as the Clean Air Act, succeeded in improving air quality while still allowing the U.S. manufacturing output to significantly expand.

This work provides clear evidence for the effectiveness of environmental regulation in reducing pollution emissions. Almost all of the air quality improvement that occurred between 1990 and 2008 can be attributed to regulation-induced reductions in manufacturing pollution. Rather than studying a specific policy change, this work observes the combined effect of all pollution regulation in this time period. The effective “price” of air pollution for manufacturing firms doubled between 1990 and 2008 due to enacted regulations. In contrast, the “price” of CO₂ did not change in this time period. This work shows that environmental regulations, such as the Clean Air Act, succeeded in improving air quality, while still allowing U.S. manufacturing output to significantly expand.