

# Pollution Takes Long-Term Economic Toll

By AUSTIN FRAKT

One argument for rolling back environmental regulations — as is occurring under the Trump administration — is that a lighter touch on industry will lift investment and economic growth.

But increased pollution can also have long-term negative economic consequences. The effects on health are bad enough on their own, and are well understood.

■ Particulate matter — a significant recent concern in California because of wildfires — as well as sulfur dioxide, nitrogen dioxide and ozone can aggravate people's airways, degrade lung function and worsen asthma.

■ Carbon monoxide can cause problems for people with some types of heart disease and, at very high levels (usually indoors), can lead to dizziness, confusion, unconsciousness and death.

■ Lead can cause cardiovascular and neurological problems. Pollution to groundwater from industrial waste can also harm health.

Less well understood is how this can affect things like educational and economic outcomes. Many studies, some focused on regions of the United States, others on cities elsewhere, have documented this kind of relationship: It's harder to perform well at work or school if you don't feel well. Additionally, if school performance suffers as a result of health problems, that threatens long-term work and earnings prospects.

Children are especially vulnerable to the effects of pollution. The fetal origins hypothesis posits that environmental conditions before birth can affect development, health and well-being. Daniel Prinz, a Harvard Ph.D. candidate, is an author of a recent paper on the subject. "The evidence is overwhelming that pollutants encountered in utero can cause long-term harm," Mr. Prinz said. (I was a co-author on this paper, along with two Harvard health economists, David Cutler and Michael Chernew.)

The 1970 amendment to the Clean Air Act significantly reduced air pollution in certain areas, offering a research opportunity. A study published last year in the *Journal of Political Economy* looked at the level of pollution experienced by children born in each year between 1969 and 1974, and also their earnings 30 or more years later.



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Berkeley Pit in Butte, Mont., so polluted that it has become something of a tourist attraction.

The study found that exposure to lower levels of pollution in their birth years led to higher earnings by age 30 and at least \$4,300 more over their lifetimes, or \$6.5 billion per affected cohort.

Another study, by authors from Northwestern and the University of Florida, examined the test scores of 13,000 children born in Florida between 1994 and 2002, when the E.P.A. cleaned up many Superfund sites.

The children were all in families with one child born before and one after a nearby Superfund site cleanup. That meant one child was exposed, in utero, to a higher level of environmental toxicity than the other. The study found that children conceived within two miles of a Superfund site before it was cleaned up had lower elementary school standardized test scores than the siblings born later. They were also 40 percent more likely to repeat a grade; 6.6 percentage points more likely to be suspended from school; and 10 percentage points more likely to be diagnosed with a cognitive disability.

But it doesn't take decades to see pollution's effect. One study of the 39 largest school districts in Texas found that when carbon monoxide levels were higher, children were more likely to be absent from school. Janet Currie, a Princeton economist, was an author of the study.

"Pollution harms everyone," she said. "But kids are hit the hardest. Pollution impacts kids' health in the short and long term, and ultimately translates into poorer labor market outcomes — lower productivity at work and lower incomes."

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effects of carbon monoxide and particulate matter on Israeli students' performance on high school exit exams that were required for college admissions. It found worse performance when pollution was greater. Scores on tests administered on one of the days ranked in the top 5 percent in carbon monoxide pollution were about 14 percent lower than average, for example.

The quantity of work produced by people can degrade at higher levels of pollution. A study found that higher concentrations of fine particulate matter depressed the productivity of pear packers in Northern California. In another study, the same authors found that when pollution was higher, Chinese call center workers took

more breaks.

Pollution may also affect the quality of work, which is much harder to measure. An intriguing study in the *Journal of the Association of Environmental and Resource Economists* got at this issue by examining how accurately baseball umpires called balls and strikes under different pollution conditions.

Since 2008, pitch calls have been checked by Major League Baseball with an electronic system. In a typical game, an umpire makes 140 ball/strike calls. When there was a 150 percent increase over average carbon monoxide levels or the same increase in small particulate matter, the study found an average of 1.4 additional incorrect calls. Levels of pollution that high occur in about one in 10 games.

Over the very long term, economic growth has been a boon to health and longevity. But when that growth is achieved through increased pollution, that can harm both health as well as longer-term economic prospects. And pollution from large-scale environmental events like the California fires may also challenge productivity at school and work, even for children only now in utero.

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