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Air quality and children's health: Experiences from two natural experiments

Peter Nilsson
Jenny Jans

Peter Nilsson, Professor of Economics at the Institute for International Economic Studies, Stockholm University

Jenny Jans, Researcher at the Swedish Institute for Social Research, Stockholm University

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This report presents the results from two studies examining the effect of air quality on children's respiratory health.

The first study examines the health effects from short-term variations in pollution levels induced by so-called inversion episodes. During an inversion episode, warmer air at higher altitudes traps air pollutants at the ground level, in contrast to normal days when the temperature decreases with altitude, which allows air pollutants to rise and disperse. This phenomenon gives rise to sharply deteriorating air quality, resulting in pollution levels frequently well above average levels.

By merging vertical temperature profile data from NASA with local pollution monitors and health care records, the results indicate that inversions increase particulate matter (PM10) by 25 percent and children's respiratory health problems by 5.5 percent. In the next step, we examine the effects of air pollution across socioeconomic groups. We find stark differences in terms of the impact of poor air quality, with children from low-income families being particularly affected. The impact of inversions is around 40 percent lower on children in high-income families compared to children in low-income families.

Among the underlying mechanisms put forward in the literature, our results show that differences in baseline health seem to be a key mediating factor behind the effect of pollution on the health gap related to socioeconomic status. We show that among children with poor baseline health, higher parental incomes seem unable to cushion the impact of poor air quality. Hence, since children in lower-income households on average have a higher baseline level of health problems, one important mechanism behind the differences in the effects of poor air quality across income groups seems to be that children in low-income households are more vulnerable due to a pre-existing lower health stock on average.

The second study presented in this report studies the health effects from a more permanent change in air quality induced by the introduction of a congestion tax in central Stockholm.

In August 2007, Stockholm implemented a congestion tax that levies charges on most vehicles entering the city center. The purpose of the tax was to reduce congestion by reducing traffic entering the central parts of the city. The permanent implementation was preceded by a seven-month trial period, called the Stockholm Congestion Trial (Stockholmsförsöket). The trial period ran from January 3, 2006 through July 31, 2006, and government estimates suggested that inner-city traffic was reduced by around 20–25 percent during this period. Based on the success of the trial program, the Swedish government decided to make it permanent. The tolls were imposed once again starting August 1, 2007, and have been collected ever since.

The full data material used in this study consists of combining data on congestion fees with data on ambient air pollution and administrative data on all inpatient and outpatient health visits. As a counterfactual for what would have happened in the absence of a congestion fee program, outcomes within the Stockholm city center are compared to outcomes in other city centers in Sweden that did not implement congestion pricing.

The results show that the tax reduced ambient air pollution by 5–15 percent. Declines in relative ambient pollution levels in Stockholm compared to other central cities show a stepwise pattern, first falling during the trial period, then rebounding somewhat during the period in-between the trial and permanent adoption to then show a sustained decline following the permanent adoption of congestion pricing.

Turning to health outcomes, the results indicate a significant reduction in visits for acute asthma attacks among children aged zero through five in the years after congestion pricing went into effect. Although congestion pricing had an immediate impact on asthma, the impact grew over time and asthma rates continued to decline during what proved to be a temporary hiatus in congestion pricing before it was adopted permanently. The findings thus suggest that congestion charges in large cities can have significant positive effects on health in the short term but even larger effects in the longer term as the stock of children's health evolves to a new lower pollution equilibrium level.

In conclusion, both studies indicate that there are major health benefits to be gained from improved air quality. Since exposure to pollutants early in life has also been shown to have a long-term impact on, for example, education and labor market outcomes, environmental policy also has an important role to play in terms of increasing equality in economic outcomes.