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Links Between Air Quality and Economic Growth

Implications for Pittsburgh

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Summary

Although Pittsburgh, Pennsylvania, is still often referred to as the “Steel City,” the region has diversified its industrial base toward service-oriented industries, such as education and health care. At the same time, the Pittsburgh region’s air quality has improved during the past several decades. But although industrial soot no longer blots out the sun, the region still faces challenges with air pollution. For example, Pittsburgh remains out of compliance with some of the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants set by the U.S. Environmental Protection Agency (EPA). In addition, EPA’s national-scale air toxicity assessment indicates that Allegheny County (in the Pittsburgh metropolitan statistical area [MSA]) ranked 63 out of 3,141 U.S. counties in overall cancer risk, 123 in overall neurological risk, and 327 in respiratory risk related to air toxicity (EPA, 2013c).¹

The primary reason to improve air quality is to achieve better health outcomes, such as reduced instances of bronchitis, asthma, and premature mortality. Improving air quality has its costs, including the capital and operation and maintenance costs to businesses that are required to install pollution control equipment, as well as the costs of regulations related to improved fuel economy. Despite some controversy over the exact nature of the costs and benefits, the total value of benefits from major clean air legislation has been shown to exceed the costs substantially (EPA, 2011a).

It is also possible that improving air quality may affect the economic performance of a local area, by improving the health of the workforce, contributing to overall quality of life, affecting business costs (via the impacts of local air quality on local regulations), or through other channels. This report examines the relationship between air quality and economic growth through three pathways:

- **Pathway 1: Health and related workforce issues and costs.** This effect links air quality to the health of the local population and subsequently to effects on the health and productivity of the local workforce. Workforce productivity and health can affect business costs and productivity, and thus local economic growth.

¹ These rankings include risks based on air toxics, not criteria air pollutants. Note that a lower number indicates a higher risk; a ranking of 1 would indicate the county with the highest risk.

Figure S.1
The Pittsburgh Metropolitan Statistical Area



SOURCES: U.S. Department of the Interior and U.S. Geological Survey, undated; Office of Management and Budget, 2013.

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- **Pathway 2: Quality-of-life issues and location decisions.** Air quality may affect quality of life for residents, either directly or through health effects. In turn, quality of life may influence business and residential location decisions, thus affecting growth.
- **Pathway 3: Air quality regulations and business operations.** The stringency of national air quality regulations varies with local air quality. Local areas with better air quality face less stringent regulations, and that affects cost and location decisions for certain businesses.

How air quality influences local economic growth through each of these pathways and how this information is relevant to the Pittsburgh region are critical but

seldom-addressed questions. Discussions of air quality improvements often focus on health outcomes (on the benefit side) and direct costs (on the cost side). By highlighting some of the links between improved air quality and impacts on workforce productivity, individual relocation decisions, and business operations, policymakers, local organizations, and others interested in air quality and local growth in the Pittsburgh region and elsewhere can engage in a new kind of dialogue that more directly links environmental and economic well-being.

Study Methods

The three pathways were identified through a rigorous review of existing economic and environmental literature. The evidence for each pathway was assessed based on the literature review. Pathways 1 and 3 were then examined quantitatively by extrapolating results from existing studies to the Pittsburgh region, to provide a sense of the local economic value associated with achieving the NAAQS. For pathway 1, improvements were estimated using several health-related metrics that would be associated with improving air quality to meet the NAAQS. For pathway 3, the fact that areas that fail to meet the NAAQS face more-stringent air quality regulations, which, in turn, affect business location and operation decisions, was considered. The changes in the number of establishments, employment, and output in selected industries that would be associated with meeting the NAAQS were estimated.

In order to assess pathway 2, as well as specific aspects of pathways 1 and 3, the team conducted semistructured interviews with representatives of 27 organizations in the Pittsburgh region and elsewhere. Interviewees included representatives of 11 firms in pollution-intensive and non-pollution-intensive industries and universities; eight community groups and academics; three government agencies involved in both environment and development issues; and five local and national site selection firms and recruiters.

How Does Air Quality Affect the Health of the Local Population?

For pathway 1, reducing concentrations of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) from 2012 levels to the current NAAQS would be associated with health improvements valued at approximately \$488 million (Table S.1). Similarly, reducing ozone concentrations from 2012 levels to the NAAQS would be associated with health improvements valued at \$128 million (Table S.2). These values are driven

Table S.1
Annual Effect of Meeting the Particulate Matter Standard on
Key Health Endpoints in the Pittsburgh Metropolitan Statistical
Area

Endpoint	Incidence Mean (number of avoided cases)	Valuation (\$ thousands)
Acute bronchitis	72	27
Acute myocardial infarction	9	446
Asthma exacerbation	1,526	238
Chronic bronchitis	42	6,405
Emergency-room visits, respiratory	38	10
Hospital admissions, cardiovascular	16	414
Hospital admissions, respiratory	18	402
Adult mortality	89	486,185
Upper-respiratory symptoms	1,323	35
Work loss days	7,243	857
Total		487,793

SOURCE: Authors' calculations using EPA's BenMAP software, with ambient air quality values updated to reflect 2012 concentrations in the Pittsburgh MSA.

NOTE: The total valuation is based on a Monte Carlo simulation of the underlying results for each endpoint and is therefore not equal to the sum of the individual valuations. The selection of endpoints relies on EPA's selection of epidemiological studies available in BenMAP.

largely by the values associated with reduced premature adult mortality.² Estimates for ozone are based on the current NAAQS of 75 parts per billion (ppb), but it should be noted that, in 2010, EPA proposed lowering the NAAQS to 60 to 70 ppb and subsequently drafted documents for a revised standard of 70 ppb. As of October 2013, however, EPA reported that it was continuing its five-year review of the NAAQS (EPA, 2013i).

Meeting the NAAQS for PM_{2.5} would include improvements in a health-related metric that may be particularly salient to local business: work-loss days. In addition, meeting the NAAQS for ozone would reduce school-loss days, which, in turn, reduces work-loss days. In Table S.2, one school-loss day is valued at the lost wages that a parent faces from taking time off to care for a sick child. The team confirmed that these find-

² Our estimates were developed using BenMAP, a geographic information system-based program provided by EPA.

Table S.2
Annual Effect of Meeting the Ozone Standard on Key Health Endpoints in the Pittsburgh Metropolitan Statistical Area

Endpoint	Incidence Mean (number of avoided cases)	Valuation (\$ thousands)
Emergency-room visits, respiratory	14	5
Hospital admissions, respiratory	26	832
Mortality	18	128,267
School loss days	5,600	566
Total		127,635

SOURCE: Authors' calculations using EPA's BenMAP software, with ambient air quality values updated to reflect 2012 concentrations in the Pittsburgh MSA.

NOTE: The total valuation is based on a Monte Carlo simulation of the underlying results for each endpoint and is therefore not equal to the sum of the individual valuations. The selection of endpoints relies on EPA's selection of epidemiological studies available in BenMAP.

ings were robust to a range of assumptions about the baseline incidence rates of work- and school-loss days.

How Do Air Quality Regulations Affect Business Operations?

For pathway 3, existing evidence indicates that, if an area is not in attainment with the NAAQS (called *nonattainment*), firms in certain regulated industries may find it more difficult to locate or to grow in that area. The team drew on results from a national study showing that counties that are in attainment with the ozone NAAQS have more establishments in regulated industries. By extrapolating these results to Pittsburgh, the team found that, in the Pittsburgh MSA, being out of attainment with the NAAQS is associated with approximately eight fewer establishments in regulated industries. Meanwhile, being out of attainment with the ozone and PM_{2.5} NAAQS is associated with approximately 1,900 and 400 fewer jobs, respectively, and with \$229 million and \$57 million less in output from regulated industries, respectively (Table S.3).

The analysis presented here is subject to certain limitations. First, when extrapolating national results to the Pittsburgh region, the team assumed that the relationship between air quality or air quality regulations and the percentage change in a metric that was identified in the literature could be applied to the Pittsburgh region. Those percentage changes were then applied to Pittsburgh-specific baseline data on the metrics. This assumption is consistent with the way in which health benefit estimates are typically constructed (EPA, 2011a). Second, it should be noted that coming into com-

Table S.3
Estimated Effect of Not Being in Attainment on Regulated Industry Outcomes in the Pittsburgh Metropolitan Statistical Area

Pollutant	Estimated Fewer Establishments in Regulated Industries in the Pittsburgh MSA	Estimated Fewer Jobs in Regulated Industries in the Pittsburgh MSA	Estimated Reduction in Output from Regulated Industries in the Pittsburgh MSA (\$ millions)
Ozone	8	1,914 to 1,946	229
TSP	Not applicable	413	57

SOURCE: Authors' calculations based on extrapolating estimates from Henderson (1996) and Greenstone (2002) to the Pittsburgh MSA.

NOTE: TSP = total suspended particulates. Pollutants examined for each outcome are based on those considered in the underlying studies.

pliance with the NAAQS entails costs on regulated industries; estimating the costs of coming into compliance was outside the scope of this study.

Summary of Findings

The team did not conduct a cost-benefit analysis and thus cannot make specific policy recommendations. However, the project did elicit three significant findings:

- **Improved local air quality would have substantial health-related benefits for the Pittsburgh region** (pathway 1). Meeting the NAAQS can reduce incidences of various health outcomes, such as premature mortality, emergency-room visits, and work-loss days. This could result in an annual benefit of \$128 million for reducing ozone from 2012 levels to the NAAQS or of \$488 million for reducing PM_{2.5} from 2012 levels to the NAAQS.
- **Cleaner air may affect workers' location decisions** (pathway 2). There is suggestive evidence that people “vote with their feet” to live in places with cleaner air, particularly when it comes to local relocations. Although there is less empirical evidence on how air quality affects intercity migration decisions, the team's stakeholder interviews offered anecdotal evidence that recruiters use all possible tools when convincing potential employees to move to a particular city. The fact that the Pittsburgh region does not meet national air quality standards thus removes one potential tool from recruiters' toolkits. Encouraging local human resource departments in Pittsburgh-area firms to gather information from applicants about what factors played a role in their decisions to accept or reject an offered job or using recruiting or survey data to examine the reasons that candidates from other

parts of the country would or would not be willing to consider taking a job in the Pittsburgh region could be important next steps in understanding the impacts of the Pittsburgh region's air quality on its potential to attract future residents.

- **Businesses in regulated industries may have an easier time locating and growing in the Pittsburgh region once air quality standards are met** (pathway 3). Although regulated industries do face costs associated with improving air quality, meeting the NAAQS can make it easier for businesses in regulated industries to locate and operate in the Pittsburgh region in the long run. In the Pittsburgh region, being designated as in attainment with the NAAQS ozone standard would be associated with eight more establishments, 1,900 more jobs, and \$229 million more output in regulated industries; being in attainment with the NAAQS PM_{2.5} standard would be associated with 400 more jobs and \$57 million more in output from regulated industries.