

How Do High Levels of Fine Particulate Matter Impact Daily Labor Supply in Mexico City?



There is a negative, non-linear relationship between fine particulate matter (PM 2.5) and same-day labor supply, with strong effects on extremely polluted days.



Workers partially compensate for lost hours by increasing their labor supply on days that follow high-pollution days.



Informal workers reduce their labor supply less than formal workers on high-pollution days and compensate less on the following days. This suggests that informal workers may experience greater exposure to high pollution and greater reductions in labor supply and income.

CONTEXT

Air pollution is the largest environmental risk to health, and the problem is most severe in the global south. A vast medical and economics literature has documented the effects of pollution on respiratory and other diseases, subsequent hospitalizations, and mortality. But can workers avoid the harmful effects of high levels of air pollution? On high pollution days workers may face a trade-off between air pollution exposure and income, and this trade-off between income and health is particularly acute for workers whose income is closely linked to the daily number of hours worked. These are usually lower-income, informal workers.

PROJECT

We use high-frequency measures of fine particulate matter (PM 2.5), which has been documented to have severe short-term and long-term health impacts. Specifically, we use hourly air pollution data from ground monitoring stations combined with the World Health Organization's (WHO) air quality thresholds to capture peaks in air pollution across days and localities in the metropolitan area of Mexico City. We combine the air pollution data with daily hospital admissions data from the Automated System of Hospital Expenditures for 2010-2016 and detailed labor market data from the National Survey of Occupation and Employment (ENOE) for 2005-2016.

Key concept



BACK-OF-THE-ENVELOPE CALCULATION

A calculation that uses rounded, approximate, or estimated numbers to calculate an approximate figure.

RESULTS

We document a negative, non-linear relationship between particulate matter and daily labor supply. Specifically, the probability of working on an average day of extremely high PM 2.5 is reduced by more than 5 percentage points, which implies an average reduction of same-day hours worked of 7.5%. This amounts to a loss of around 280,000 person-days of labor on a high-pollution day.

Workers compensate for decreases in labor supply on high pollution days by increasing their hours worked in the following days. Moreover, pollution shocks are highly correlated within the household, and workers' ability to reallocate labor hours across working household members is limited.

The effects of high pollution on labor supply are heterogeneous. Informal workers reduce their contemporaneous labor supply by significantly less than formal workers on high-pollution days. Further, informal workers also compensate less than formal workers in the following days. As a consequence, compared to formal workers, informal workers are likely to suffer worse health impacts on contemporaneous days and work fewer hours (i.e., lose more income) over the 6-day period.

Work commitments and income constraints are likely to play a role in workers' labor supply decisions, which could explain the heterogeneity in labor supply responses. This suggests that avoidance is a more plausible explanation than cumulative negative health impacts or lower productivity, i.e., a lower opportunity cost of missing work.

Consistent with a trade-off between income and health, PM 2.5 has a positive, non-linear relationship with hospital admissions for respiratory diseases that mirrors the relationship between PM 2.5 and labor supply. These results are driven by areas with higher shares of informal workers. Together with the heterogeneity in labor supply response, these results suggest that informal workers likely experience worse income reductions and health effects due to high PM 2.5 than formal workers.

POLICY IMPLICATIONS

Our results have two key policy implications. First, reductions in labor supply are an important negative externality of fine particulate matter. A back-of-the-envelope calculation based on our estimates suggests that workers in the metropolitan area of Mexico City lost labor earnings of US\$1.2 million due to reductions in labor supply on days with particulate matter above the World Health Organization's least ambitious target. This is approximately US\$430 million per year. The strong non-linear relationship of PM 2.5 with labor supply and respiratory diseases indicates that policies should focus on decreasing peak levels of fine particulate matter.

Second, we find that the costs of air pollution are unequally distributed across workers. We find greater cumulative reductions in labor supply and negative health impacts of fine particulate matter for workers with lower and more uncertain income, which may be exacerbating income inequality within Mexico City. Further, the results suggesting that income constraints affect labor supply responses to air pollution suggests an important role for social programs. Informal workers do not have access to public paid sick leave and are unlikely to have paid sick leave from their employers. Social programs that provide support informal workers on high-pollution days could allow them to avoid steep drops in income while engaging in avoidance behavior that could reduce the risk of negative health outcomes.

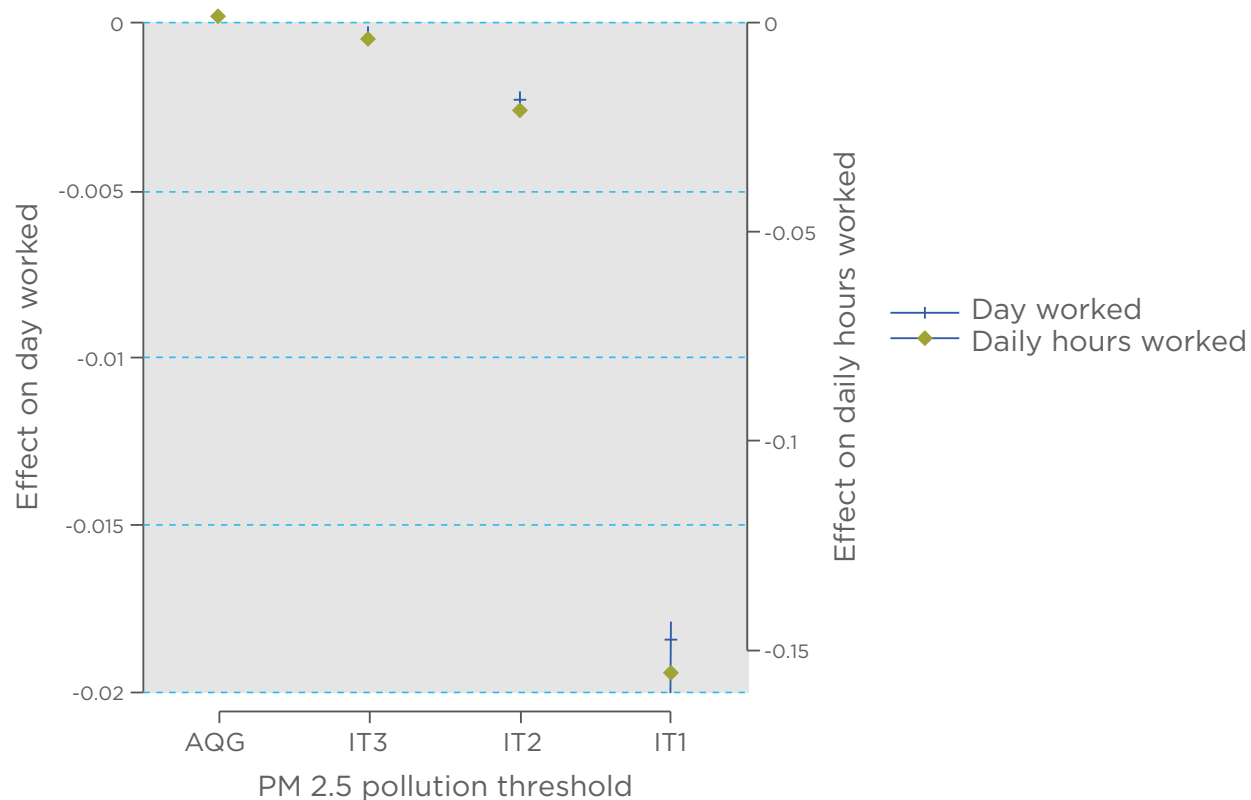
Key concept



FINE PARTICULATE MATTER (PM 2.5)

Particles are monitored and regulated according to size, most commonly those with respective diameters of less than 10 μm (PM 10) and less than 2.5 μm (PM 2.5).

Figure 1. Impact of High PM 2.5 on Working the Contemporaneous Day and Same-Day Hours Worked



Notes: Coefficients and 90% confidence intervals are plotted from a separate regression for each threshold (using the number of hours above the WHO air quality threshold for PM 2.5) and outcome. The left axis shows the impact on working that day and the right axis shows impact on hours worked that day.



FULL STUDY

[Hoffmann, Bridget, and Juan Pablo Rud. 2022. “Open Configuration Options Exposure or Income? The Unequal Effects of Pollution on Daily Labor Supply.”](#)

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