

**Local Pollution Drives Global Pollution:
Emissions Feedback via Residential Electricity Usage**

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May 15, 2019

Abstract

This study finds that a significant and hitherto ignored determinant of home energy demand is ambient particle pollution. I causally link two major societal phenomena and show that this link matters. First, home energy demand is increasing sharply as incomes rise in the urbanizing developing world. Second, particle pollution (PM_{2.5}) afflicts much of the world's rising middle classes. I access longitudinal data for Singapore, a newly affluent Asian city-nation and arguably a harbinger of what is to come in the urbanizing tropics. Singapore today combines high (yet unequal) defensive capital stocks, such as residential air conditioning, with widely varying PM_{2.5}. Overall, residential electricity demand grows by 10% when PM_{2.5} rises by 100 $\mu\text{g}/\text{m}^3$. I compare the pollution-electricity response to the well-known heat-electricity response, and show how it varies over the socioeconomic distribution. Local pollution control has the co-benefit of reducing electricity generation, via lower household demand, and thus mitigating carbon emissions. The observed inequality in defensive expenditure may also exacerbate health inequalities, as suggested by an exchange between epidemiologists and government.

Keywords: Energy demand, air quality, PM_{2.5}, pollution control co-benefit, household electricity, air conditioning, defensive expenditure, rising middle class, energy inequality, health inequality, environmental justice, longitudinal study, instrumental variables

JEL codes: D12, I14, L94, O13, Q41, Q51, Q53, Q54, Q56

*Department of Economics, National University of Singapore, albertosalvo@nus.edu.sg. I am grateful to Phyllis Ang, Jeanne Cheng, Eric Fesselmeyer, Teck Hua Ho, Ivan Png, Benjamin Soo, Denis Tan, Lionel Wee, Melvin Wong, and Julian Wright for facilitating data access, as well as the organizations mentioned in the text for generously sharing their data. For feedback, I thank discussants and audiences at ASSA; Duke University; the Economics of Energy, Environment and Climate workshop at Peking University; the Economics of Low-Carbon Markets workshop; Jinan University, National University of Singapore; UC Davis; UC Santa Barbara; and World Congress of Environmental and Resource Economists, including Dave Keiser, Lala Ma, Dimitri Sberman and Cheng Xu. I thank Fu Ginn Cheong and Weiliang Tan for research assistance and acknowledge support from Singapore's Ministry of Education Academic Research Fund Tier 1 (R-122-000-235-112).

Data and code availability Proprietary household-level utility usage microdata can be purchased from SP Services Ltd. To allow approximate verification, the author will make electricity and natural gas use data aggregated to usage period by two-digit zip code by dwelling type triple available in a public repository. Moreover, upon reasonable request, the microdata are available on an NUS Department of Economics (or equivalent institutional) computer to replicate all published results from the deposited computer code. The author will make all other data, including the survey of home energy behaviors, and all code available in a public repository.

Competing financial interests The author declares no competing financial interests.