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The Demand for Air Quality: A Case study in Bogotá, Colombia

Authors:
Fernando Carriazo and John Alexander Gomez
Universidad de Los Andes

Bogotá is one of the most polluted cities in Latin America. Particulate matter less than 10 µg/m3 (PM10) is a criteria pollutant that exceeds, in many neighborhoods, the local air quality standard of 55 µg/m3. Clean air is a public good that has an economic value even though there is no relevant market where its value is expressed. The local environmental agency has made some efforts to curb pollution levels mostly based on command and control policies. However, very little is known about the potential welfare effects of air quality improvements, or how economic values related to air quality are constructed from people´s choices and preferences. This study intends to fill these gaps by estimating a demand function for air quality.

The identification of this demand function is important because it helps us to better understand how households' marginal valuation of air quality changes as air quality improves. This identification is also important because a demand function may be used as an analytical tool for policymakers to estimate a household´s total valuation of pollution abatement policies, thus providing evidence of the importance of urban amenities, including ambient quality. Furthermore, as an analytical tool, non-market measures obtained from this demand function are aimed at enriching the discussion of the potential role for public policy in the provision of urban amenities, including clean air.

Our empirical application relies on housing markets since they could reveal demand information for local public goods and for environmental quality. To identify a demand function for air pollution reductions, we used 11,492 housing rents and detailed socioeconomic household information as well as georeferenced urban amenities, including local ambient quality.

To calculate potential welfare effects derived from pollution control policies, we further estimate consumer surplus measures due to the compliance of emission standards for two counterfactual scenarios: 1) the U.S Environmental Pollution Agency (EPA) standard, 2) the World Health Organization (WHO) standard.

Our empirical results first confirm that air quality is capitalized in property values. However, these capitalizations vary from one housing submarket to another. Capitalizations seem to have a larger effect on condominiums compared to dwellings in other submarkets such as apartments and houses. Second, the Estimation of Total Willingness to Pay (TWTP) for particulate matter reductions suggests average per household monthly benefits of US$7.12 for compliance with EPA standards and US$72.91 for compliance with the WHO standard. These benefits represent, respectively, about 1% and 8% of average household income. Third, the demand function helped us understand how these benefits may also vary by socioeconomic strata. (See Table 1 below).

Table 1. Total Monthly Willingness to Pay for Air Pollution Reductions

	Elasticity (%)	TWP for WHO Standard (20 m/m3)		TWP for EPA Standard (50 m/m3)	
General	-1.502415	72.91	[8.09]	7.12	[.79]
Low Strata	-.6770902	56.28	[13.84]	11.59	[2.85]
Med Strata	-1.770291	78.12	[7.35]	2.92	[.27]
High Strata	-6.516673	106.17	[3.27]	-29.2	[-.9]

Percentage of monthly income reported in square brackets

These benefits are to be interpreted as a lower bound since the identification of preferences from the applied model does not capture potential impacts on health. Nonetheless, our estimated values from revealed preferences could be incorporated in cost-benefit analyses concerning regulatory policies to control urban air pollution. Our empirical results are relevant to a real problem and we expect that new regulations would only be carried out if the economic benefits yield a positive present value for the society.

We highlight the importance of linking detailed housing market information with socioeconomic information for households and urban amenities in order to identify the demand function for ambient quality. We showed that using economic theory and econometric methods to estimate the monetary value people place on environmental resources such as clean air may be a powerful analytical tool for future evaluations of clean air policies since most of them will deal with regulations that need to be economically assessed. Equally important, we illustrated how the demand function can be flexibly used to calculate benefits for various ambient quality scenarios. Total benefits from air quality improvements need to be compared to total abatement costs arising from current and future regulations in order to guide policymakers and regulators towards more cost-effective policies.

Fernando Carriazo is Assistant Professor of Economics at Universidad de Los Andes in Bogotá, Colombia.

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