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Analysis

The Value of Ozone Air Quality Improvements to Renters: Evidence From Apartment Building Transactions in Los Angeles County☆

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ABSTRACT

We investigate the relationship between the sale prices of apartment buildings and ozone levels in Los Angeles. The hedonic estimation controls for the potential bias resulting from the endogeneity of air pollution measures. We find that renters' valuations for air quality are capitalized into the asset price of apartment buildings. For a 1% reduction in the 1990 ambient air pollution level, renters' annual marginal willingness to pay (MWTP) is estimated at $14 to $52 in constant 2010 dollars. These estimates are somewhat smaller than current MWTP estimates from the owner-occupied single family house literature.

1. Introduction

Determining how best to value urban air quality improvements has long been a major subject of the environmental valuation literature (see e.g. Smith and Huang, 1995; Chay and Greenstone, 2005; Beron et al., 2001). In general, the literature has relied on the equilibria in the housing market to reveal household preferences for various pollutants. The initial research relied on the hedonic theory established by Rosen (1974), and estimated marginal value of air quality improvements. Work by Sieg et al. (2004) and Tra (2010) has also introduced structural models to account for household relocations in response to discrete changes in air quality.

Empirical models of hedonic housing values rely almost exclusively on sales transactions of detached housing units.[1] As a consequence, the analysis investigates willingness to pay for air quality of the owners of these houses. This focus neglects a significant portion of the population. For example, in Los Angeles, where our study is based, almost 50% of the population lives in rental housing, and of the rental units, about 65% are apartments (US Census Bureau, 2012). Thus, over 30% of the residential population is not covered by the valuation literature. To date, the empirical literature on the value of urban air quality reveals nothing about the values that accrue to apartment dwellers.

It would be natural to use the values of owners as proxies for renters. However, the values for renters and owners may diverge for a variety of reasons. First, the renter population has different characteristics from those owning their own homes: renters have lower income and are less likely to live in a married-couple household and more likely to commute by walking or taking public transportation (Table 1). The smaller housing units and the greater tendency to walk or take public transportation mean that individuals in renter-occupied housing units may spend a greater amount of time than homeowners outside and exposed to air pollution. Renters are also more recent occupants of their housing than homeowners, which is expected, since renting agreements tend to be more short-term in nature than housing purchases. In addition, the characteristics of owner-occupied housing vary considerably from characteristics of renter-occupied (Glaeser and Gyourko, 2007), and little arbitrage is seen between rental and owner-occupied housing.

Different valuations of air quality can be expected from the renting and homeowning population, since they have different characteristics, such as the number of vulnerable family members, the duration of renting or owning the property, time spent outdoors exposed to pollution, and household income. There is some evidence of the difference between owners and renters from Grainger (2009), who investigated the difference between median gross rental rates and median owner-

☆ The views are those of the authors and should not be attributed to the Economic Research Service or the U.S. Department of Agriculture.

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[1] Studies using occupant-assessed value of the housing unit include renter-assessed values as well as owner-assessed values—for example, Chay and Greenstone, 2005; Tra, 2010; Grainger, 2009.

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Table 1
Occupant characteristics of owner-occupied and renter-occupied housing units in Los Angeles County.

	Owner-occupied	Renter-occupied	All
Housing units	1,552,091	1,665,798	3,217,889
Median household income in the past 12 months (in 2010 inflation-adjusted dollars)	$81,308	$38,549	$55,476
Proportion of married-couple households	59.7%	32.3%	45.5%
Median number of rooms	5.9	3.6	4.7
Median year householder moved into unit	1996	2005	2002
Average number of vehicles available	2.21	1.35	1.77
Proportion using public transportation	3.1%	11.3%	7.1%
Proportion walked	1.3%	4.1%	2.6%

Source: United States Census Bureau, American Community Survey 2006–2010, estimates for 2010, Los Angeles County.

occupied housing from the Census data. He found that the effect of cleaner air is more pronounced for owner-occupied housing values than rents. Our results are consistent with this finding.

In this paper, we provide the first estimates of the willingness to pay for urban air quality by apartment renters. We investigate the relationship between the sale price of apartment buildings and ozone pollution in Los Angeles. Nationally, Los Angeles had the highest number of exceedances of the national ambient air quality standard for ground-level ozone in 1996 (EPA, 1998). In general, we expect renters to have preferences on air quality, and hence, for transactions prices of apartment buildings to reflect these preferences when they are subject to competitive market forces.

Ground-level ozone is the prime ingredient in smog and causes adverse health effects, such as lung inflammation, chronic respiratory illnesses, chest pain, cough, and premature aging of the lungs, particularly in children, the elderly, and individuals with pre-existing respiratory diseases, such as asthma or chronic obstructive lung disease (EPA, 1998). Several studies and meta analyses associate daily ozone concentrations with mortality in different US and Canadian cities (Goldberg et al., 2001; Bell et al., 2005; Ito et al., 2005; Levy et al., 2005). Ground-level ozone also affects sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas (EPA, 2017). Los Angeles has one of the highest levels of ozone pollution in the US and has repeatedly violated federal ozone standards. The South Coast Air Quality Management District (AQMD), the agency responsible for monitoring air quality, estimates that it will take until 2030 to meet the stricter 2008 federal ozone standard (AQMD, 2015).

Throughout our study period of 1992–2008, air quality remained a concern for Los Angeles residents. The Public Policy Institute of California (PPIC) found in their surveys that 40% of Los Angeles residents considered air pollution to be a "big problem" in 2000, increasing to 47% in 2004 and 2008 (PPIC, 2008). In 2004, 28% of Los Angeles residents considered air pollution to be a "very serious" threat to their health and the health of their immediate families, declining to 21% in 2008. Since the earliest survey in Los Angeles residents consistently named air pollution (37% in 2000, 41% in 2004, and 24% in 2008) as the most important environmental issue facing California.

Since 1977, the AQMD has measured and reported air quality. For its 37 Monitoring Area and General Forecast Area, the AQMD issues a daily air quality forecast as well as the current air quality conditions. This air quality information is transmitted to the public through newspapers, television, radio and pager services, through faxes to schools, through recorded messages on the AQMD's toll–free Smog Update telephone line, 1–800–CUT–SMOG, and on the AQMD's Internet Website. In addition, citizens can subscribe to services that email or text daily air quality measures reported by the EPA (Enviroflash). Individuals, in particular those with asthma, are found to respond to daily air quality forecasts (Neidell and Kinney, 2010).

A recent website article giving tips for finding an apartment to rent includes a Los Angeles Times (Barboza, 2014) pollution mapping suggestion, so apartment searchers can determine where pollution is most prevalent (Champlin, 2014). The mapping tool, which showed local ozone levels at the zipcode level in 2013 and at the census tract level beginning in 2014 (Fig. A1), is called CalEnviroScreen and was put together by California's Environmental Protection Agency (OEHHA, 2014). The AQMD also provides an interactive Emissions Data Inquiry tool which indicates number and amount of pollution by zip code annually since 2000 (AQMD, 2016). Some of older AQMD reports are still available, such as "Maximum Ozone Concentrations & Number of Days Exceeding Standards By Area within Los Angeles County from 1995–2000" (LA Almanac, 2016). Finally, the California Air Resources Board Select8 program provides information on many pollutants by monitoring site, county, and air basin back to 1972 (CA-ARB, 2016).

Thus, even in the early 1990s, prior to widespread use of the internet, Los Angeles residents would have been aware of the repeated violations of federal ozone standards and the associated effects on health, publicized, for example, through the Los Angeles Times (Reed, 1992; Cone, 1996), and would have had access to location-specific information on ozone from AQMD, which maintained a network of monitors throughout the region since 1977. With more than two in five Los Angeles residents considering air pollution to be a "big problem" from 2000 to 2008, we assume that throughout our study period, and in particular when internet use became more widespread, renters are informed and care about ambient pollution levels.

To estimate the relationship between ambient air pollution and apartment building prices, we employ a dataset of the sales of all apartment buildings having 5 to 19 apartments in Los Angeles County between 1989 and 2008. We measure ambient air pollution using ozone concentrations. We estimate, via regression, the price of an apartment building as a function of the characteristics valued by occupants, including apartment characteristics, neighborhood variables, environmental attributes, and a variety of fixed effects to control for time-invariant unobservable location specific traits.

When time-varying omitted variables are correlated with ambient air pollution and apartment building prices, ambient air pollution measure becomes endogenous. The resulting regression estimate of the estimated implicit price of air quality is biased. We employ two estimation strategies to address this problem: an instrumental variables (IV) approach as well as a rational expectations approach based on Bajari et al. (2012).

For the IV estimation, we use the distance to the ocean beyond 0.5 miles, interacted with a set of time fixed effects, as an instrument for ambient air pollution. The basis for the instrument is the divergence of the physical effects of distance from the ocean on ozone and the