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The distributional effects of pollution regulations: Do renters fully pay for cleaner air?

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ABSTRACT

Changes in housing prices play an important role in determining the incidence of environmental regulations: if the increase in value due to changes in environmental amenities is fully passed forward in the form of higher rental prices, renters may receive no net benefit from the regulations. To estimate the pass-through of the value of an environmental amenity, I exploit the reduction in suspended particulate matter (PM_{10}) due to the 1990 Clean Air Act Amendments (CAAA). Using instrumental variables at varying levels of spatial aggregation I find that the 1990 CAAA led to a significant increase in rents, but the estimated percentage effect is about half as large as that of owner-occupied housing values. Little of this difference is driven by income differences between renters and homeowners; when stratifying by income and comparing the effect of the 1990 CAAA on housing values and rents, point estimates suggest that half of the increase in value is passed on to renters in the form of higher rents. This suggests that pass-through may be incomplete, but landowners still capture much of the value of the air quality regulations.

1. Introduction

The reduction in suspended particulate matter (PM_{10}) due to the 1990 Clean Air Act Amendments (CAAA) has been well-documented (e.g. Auffhammer et al., 2009). However, who wins and loses from these regulations remains an open question. Households may benefit from cleaner air through better health, clearer views, or more enjoyment from outdoor activities, and an active area of research has been to estimate how improvements in air quality are capitalized into housing prices or wages.[1] Previous studies have found that decreases in pollution lead to increases in owner-occupied housing prices (see, for example, Smith and Huang, 1995; Chay and Greenstone, 2005; Bayer et al., 2009), but the capitalization into rental housing values would have different and important distributional implications: if the increase in value is fully passed forward to renters in the form of higher rents, poor renters living in these areas may may be no better off if they value the marginal improvements in air quality less than the increase in rents they are paying (e.g. Kahn, 2001; Sieg et al., 2004; Fullerton, 2011). In this paper, I find that the pass-through to renters may be less than complete; point estimates suggest that only half of the increase in value is shifted forward in the form of higher rents.

Economists have spent decades estimating the relationship between environmental characteristics and housing prices, and there have been some important advances in recent years to overcome the bias in traditional, cross-sectional hedonic pricing models. However, few authors have examined the differential effects of pollution regulations on owner-occupied housing values vs. rents, and it matters for distributional reasons whether the elasticity of housing rents with respect to air quality is the same as, or different than, that elasticity for owner-occupied housing. Sieg et al. (2004) present a theoretical model to measure general equilibrium willingness to pay for a spatially delineated public good. They then present structural estimates of their model using data from ozone pollution in Los Angeles from 1990 to 1995. Though their focus is not on the effects of air quality regulations, they find that areas with the largest improvement in air quality tend to have increases in rental prices, and areas with more marginal changes had decreases in prices. Recently Greenstone and Gallagher (2008) use a regression-discontinuity design to study the impacts of the EPA's Superfund-sponsored cleanups of hazardous waste on housing prices. They estimate the effect on owner-occupied values as well as rents and find small, insignificant effects. In addition, Davis (2011) studies the effect of power plants on local housing values and rents, and the estimated percentage effect on rents is generally smaller in magnitude than the effect on housing values. However, he does not test for differences or discuss distributional implications.

The incidence of environmental regulations is important to policymakers, but it is difficult to quantify because distributional effects come in many forms (Fullerton, 2011). One channel through which environmental regulations have distributional effects is the capitalization into property values, and this effect is very different for owner-occupied vs. rental housing. Property owners at the time of improvement experience a capital gain, whereas renters can either pay the value that the market places on the air improvement or relocate,

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[1] For an earlier overview of the hedonic pricing literature, see Champ et al. (2003).

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which is costly. There have been several recent attempts to estimate the distributional effects of air pollution regulations.[2] Kahn (2001) takes a before-and-after approach to determine the relationship between pollution exposure and income in Los Angeles. He assumes that any reductions in pollution were induced by the 1990 CAAA and examines the changes in exposure for different demographic groups in California. He discusses the possibility of regressive benefits due to changes in rental housing prices, though he does not estimate the relationship between housing prices and pollution. Citing work by Kiel and Zabel (2000), he argues that poor people and minorities have likely not experienced increases in rental costs, though their hedonic estimates use owner-occupied housing prices. In a recent paper, Banzhaf and Walsh (2008) use an equilibrium sorting approach to provide a formal test of Tiebout's (1956) hypothesis that people "vote with their feet." They find that environmental improvements lead to changes in community demographics, noting that such sorting provides an alternative explanation to the environmental gentrification argument prevalent in the environmental justice literature (e.g. Goldman and Fitton, 1994).

In this paper, I estimate the effect of the 1990 Clean Air Act Amendments on rents and owner-occupied housing values. The focus of this study is on suspended particulate matter (PM_{10}) because it has been shown to be correlated with health outcomes,[3] and because it is visible, it is reasonable to believe that property values would respond to changes in PM_{10} levels. I begin by discussing differences between rental and housing markets and reviewing the hedonic pricing approach. Following Chay and Greenstone (2005) I use the county-level nonattainment status[4] as an instrument for the suspended particulate matter concentration (PM_{10}) to estimate the effects of the 1990 CAAA on housing values and rents.[5] In contrast to the previous literature, I also employ an overidentified model based on the findings in Auffhammer et al. (2009), who show that there was variation in the reduction or particulate matter concentrations within nonattainment counties. I find that the estimated elasticities are larger than Chay and Greenstone's estimates using data from the 1970s, which suggests that contemporary willingness-to-pay for clean air may be higher than their estimates. Comparing across housing types, the results indicate that the elasticity of rents with respect to air quality is about half as large as the elasticity for owner-occupied housing values. However, little of this difference can be attributed to differences in income between renters and homeowners. When stratifying by income and comparing the effect on housing values and rents within an income group, the difference in the effect on housing values and rents persists. Point estimates suggest that half of the increase in value is passed forward in the form of higher rents.

2. Rental vs. owner-occupied housing

The literature on capitalization and distributional effects of environmental regulations generally assumes away any systematic difference between the effects of cleaner air (or changes in other amenities due to environmental regulations) on housing values and rents. Indeed, for convenience researchers often focus on one housing type, while others convert rental housing prices to owner-occupied values (or vice versa) to make all housing prices in the sample comparable (e.g. Tra, 2010; Bayer et al., 2007; Bayer et al., 2008).[6] While the capitalization rates into property values could indeed be the same, in the case of rental properties the landowners may not be able to fully pass on the increase in value in the form of higher rents.

While I am not aware of any empirical studies of the pass-through of the value of environmental amenities, the literature on property taxes finds mixed results regarding the pass-through to renters.[7] For example, Dusansky et al. (1981) find that forward-shifting of residential property taxes to renters is incomplete. Similarly, Lopez et al. (1994) find that a 10% increase in agricultural property taxes leads to a 4.9% increase in agricultural rents.

Moreover, a recent study by Kirwan (2009) finds that renters of farmland capture three-quarters of the value of agricultural subsidies. In contrast to economic theory, the owners of farmland do not capture the majority of the subsidies. He argues that the standard prediction of economic models (with fixed inputs such as land) may not hold because of imperfect competition.

Similar to agricultural subsidies, a standard model in the case of environmental amenities may predict a perfect pass-through. However, imperfect competition or other market frictions could lead to a less-than-complete pass-through.[8] Other differences between renters and homeowners could lead to different elasticities with respect to the environmental amenity. Preferences for air quality could be driven by health concerns. Homeowners' valuation of clean air may simply be higher if parents are more likely to own than rent. Finally, unobserved expectations may play a role: if homeowners anticipate further reductions in air quality, that may be capitalized into owner-occupied prices, whereas renters would pay for *current* air quality.

Furthermore, Glaeser and Gyourko (2007) argue that the empirical relationship between rents and owner-occupied housing values often strays far from the theoretical relationship that relates the two markets through arbitrage conditions. Indeed, owned homes are very different from rental homes, and the average renter is very different from the average homeowner, particularly in income and mobility. Empirically there is limited movement by owners back into rental housing.[9] Furthermore, in the short run, volatility in housing prices combined with risk aversion precludes attempts to arbitrage, and Glaeser and Gyourko conclude that they "are skeptical that rental data can tell us much about the appropriate price of a house" (p. 39).[10]

The difference in the effect of cleaner air on rents and owner-occupied housing values is an empirical question, but the difference largely determines the distribution of benefits of the 1990 CAAA. If the improvement in air quality due to the CAAA is capitalized into owner-occupied housing values, homeowners at the time of improvement experience a capital gain. However, to the extent that rents fully reflect the improvement in air quality, landlords benefit while renters may be no better off.

[2] This paper focuses on housing market capitalization of the Clean Air Act, which is just one channel that may differentially affect high and low-income groups. For an overview of the literature on distributional incidence of environmental policies, see Parry et al. (2005) or Fullerton (2009). Studies of the cost-side incidence of environmental policies include Parry (2004), Fullerton and Heutel (2007), Grainger and Kolstad (2010), and Metcalf (1999).

[3] Particulates smaller than 10 μm are respirable. See Hall et al. (1992) for an overview of health risks associated with PM_{10} exposure, and Chay and Greenstone (2003) for evidence related to infant mortality for TSPs.

[4] Under the 1990 CAAA, the EPA designates counties as being in nonattainment if they exceed national ambient air quality standards. These counties are targeted by regulators, and are subject to sanctions if they are not brought back into compliance. This is discussed in greater detail in the following section.

[5] Chay and Greenstone studied the effects of the 1970 Clean Air Act. At that time, total suspended particulates (TSPs) was one of the criterion pollutants. More recently the EPA has differentiated particulate matter by size, so I focus on PM_{10}—particulate matter less than 10 microns in diameter. Furthermore, following a similar approach will allow a comparison of willingness-to-pay for pollution reductions in the 1990s with their estimate from the 1970s.

[6] As a simple example, one could multiply the annual rent by 1/r to get the approximate housing value.

[7] For an overview of the traditional urban models, see Mieszkowski and Zodrow (1989), Aaron (1975) and LeRoy (1976).

[8] For example, Genesove (2003) showed that apartment rents are nominally rigid.

[9] Less than four percent of owners ever transition to renting, and of those that do, one-third move back into owner-occupied housing within two years (Sinai, 1997).

[10] Other possible explanations include differences in supply elasticities for owner-occupied vs. rental housing, or differences in preferences for clean air between renters and owners.