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Is energy efficiency capitalized into home prices? Evidence from three U.S. cities[☆]

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ABSTRACT

We test for evidence that energy efficiency features are capitalized into home prices in three U.S. metropolitan areas. Using hedonic regressions and multiple matching procedures, we find that Energy Star certification is associated with higher sales prices in two of the markets: the Research Triangle region of North Carolina and Portland, Oregon. We find that local “green” certifications in Portland and in Austin, Texas, are also associated with higher prices and that the estimated price impacts are larger than those from Energy Star. Matching on observables proves to be important in some cases, reducing the estimated impacts compared with models without matching. We calculate the implied energy savings from the estimated premiums and find that, in the Research Triangle market, the Energy Star premiums approximately equal the savings that program is designed to achieve, but in Portland, the premiums are slightly greater than the program’s savings due to low energy costs in the region.

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Introduction

One oft-cited explanation for underinvestment in residential energy efficiency is that homeowners do not expect to occupy their homes long enough to realize energy savings benefits that offset up-front investment costs. If energy efficiency features of a home are capitalized in the selling price, then homeowners could recoup their costs when they sell their homes, but asymmetric information is likely to be a barrier (Bardhan et al., 2014). Home buyers may be unable to accurately observe a home’s energy efficiency because features such as wall and attic insulation, air ducts, and even heating and cooling equipment efficiencies are difficult to see or fully understand. Moreover, sellers may not be able to credibly signal that they are selling an energy-efficient home.

The federal government’s Energy Star program was established, in part, to overcome some of these information problems. Homes certified under the program are designed and built to be 15 percent more efficient than homes that meet most current building codes. In earlier days of the program, certified homes were to be 30 percent more efficient. To obtain the Energy Star label, a home must go through a process of inspections, testing, and verification set up by the U.S.

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Environmental Protection Agency (EPA). The number of Energy Star certified homes has grown over the years; the EPA estimates that 26 percent of all housing starts in 2011 were Energy Star certified (US EPA, 2012a). In addition to Energy Star, the U.S. Green Building Council administers the Leadership in Energy & Environmental Design (LEED) certification program and many localities have their own certification schemes.¹

In this study, we analyze the effect of Energy Star and two local “green” certifications on sales prices of homes in three urban areas: Austin, Texas; Portland, Oregon; and the Research Triangle area (Durham-Raleigh-Chapel Hill) of North Carolina. These localities are chosen because realtors participating in the multiple listing services (MLS) in these regions have agreed to report a set of green characteristics on home listing sheets. These data include information on green and energy efficiency certifications that could reduce the extent of imperfect information in the market for residential real estate.² We examine over 170,000 sales transactions for single-family homes over the 2005–2011 time period. We employ a combination of spatial matching, propensity score matching, and regression analysis to mitigate potential bias in our estimates of the relationship between certification and house prices in each of the three cities.

Our results show that Energy Star certification is associated with an increase in the sales prices of single-family homes in the Triangle and Portland markets of about 2 percent. We find no statistically significant effect in Austin, though the 95 percent confidence interval includes the 2 percent point estimates in the other two markets. The local certifications in Austin and Portland appear to have larger effects on sales prices than Energy Star. In Austin, homes that have the local certification sell for 8–9 percent more than noncertified homes, after matching and conditioning on a set of house characteristics. In Portland, locally certified homes sell for approximately 4 percent more. These local certifications go beyond energy efficiency to encompass other environmental attributes such as water efficiency, landscaping choices, and building materials, which likely account for some of the price premium. Builders, realtors, and individuals at the certification agencies in the two cities believe that the local certifications are a symbol of overall quality in materials and construction, which could also explain the difference. The larger effect in Austin than Portland suggests heterogeneity across the two housing markets. In our view, the heterogeneity is attributable to differences in climate, consumer preferences, and other factors affecting housing markets, but also to some differences in the way the two certification programs operate, which we discuss further below.

Our empirical framework is not able to identify what specific aspects of certification are of value to homebuyers, or whether there is an intrinsic value to the label itself. But to put our findings in some perspective, we compute implied annual energy cost savings from our estimated sales price premiums and compare them to estimates of average annual residential energy costs. Although the capitalization effect of 2 percent for Energy Star homes in Portland and Triangle is modest, the implied savings are 13 to 15 percent of the estimated average annual energy costs of a home in the Research Triangle market and 22 to 24 percent in the Portland market.³ The implied savings in Triangle are almost identical in magnitude to the Energy Star requirement, in effect since mid-2006, that homes be 15 percent more energy efficient than noncertified homes built to meet a standard international energy code. This suggests that the Triangle housing market may be appropriately capitalizing the energy savings embodied in Energy Star. In Portland, average household energy costs are relatively low, thus it is possible that a slight overcapitalization of Energy Star exists in that market, at least for the years we consider. The higher estimated price premiums on the local green certifications would imply substantially higher energy savings—well beyond the 13–24 percent we estimate for Energy Star—which serves to emphasize that these green labels provide benefits to homeowners beyond energy efficiency.

Most recent studies of Energy Star and other certifications have focused on commercial buildings. Eichholtz et al. (2010), using data on U.S. office buildings from the 2004 to 2007 time period, find that buildings with LEED or Energy Star certification have contract rents that are 3 percent higher than noncertified buildings and effective rents (contract rent multiplied by occupancy) that are 6 percent higher; sales prices are 16 percent higher for certified properties. Subsequent analysis using additional data confirmed these findings (Eichholtz et al., 2013). Related research on commercial buildings in Europe has reached similar conclusions (Kok and Jennen, 2012).

Early studies of energy efficiency in residential buildings found a positive correlation between home sales prices and various measures of energy efficiency (e.g., Dinan and Miranowski, 1986; Laquatra, 1986; Johnson and Kaserman, 1983). However, these studies were limited by small sample sizes. In recent work, Brounen and Kok (2011) find houses in the Netherlands with “green” labels under the EU Energy Performance Certificates transact at a premium of roughly 3.5 percent relative to comparable houses with lower efficiency ratings. Hyland et al. (2013) analyze a rating scheme in Ireland in which homes are given a score on a 15-point scale based on the measured efficiency of the heating and water heating equipment, insulation, and lighting. They find that each 1-point decline on the scale reduces sale prices by 1.3 percent and rents by 0.5 percent. Deng and Wu (2014) study the Green Mark certification scheme in Singapore. They

¹ See <http://www.usgbc.org/leed> for more information on LEED.

² A “greening the MLS” movement by some energy efficiency advocates and the National Association of Realtors (NAR) is pushing to have green certifications and a host of energy-related and other green features of homes included on sales listing sheets. See <http://www.greenresourcecouncil.org/green-resource-council-info/greening-mls> for more information (accessed August 30, 2016) and NAR (2014) for an implementation guide. Although the listing sheets can include more information than just certifications, such as the efficiency levels of heating and cooling equipment, we found that other information was generally absent in the three MLS programs we analyzed.

³ These figures assume a 5 percent annual discount rate over 30 years and use energy costs in 2007 and 2010. We also compute the annual estimates for alternative discount rates and time horizons.

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