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Proof of concept that requiring energy labels for dwellings can induce retrofitting☆

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ABSTRACT

How to induce households to install energy efficient technology remains a puzzle. Could an energy labeling requirement for residential real estate help? We propose that the salient color-letter grades on the English Energy Performance Certificate (EPC) served as targets, motivating vendors to invest in energy efficiency. To test our hypothesis we look to a random sample of over 16,000 homes in England. In the post-EPC data we find a cluster of homes with energy efficiency scores just above the D-grade threshold. This cluster was not present prior to the requirement, replicates in an independently-drawn random sample and is significantly larger amongst properties that can be identified as treated by the EPC requirement. We conclude that the EPC requirement induced investment, and hence that energy efficiency labels have potential to green the housing stock. We infer from our analysis how the design of the EPC could be altered to motivate greater investment in energy efficiency.

1. Introduction

There are two pathways to reducing household energy consumption: curtailment and retrofitting. While several prominent journal articles have pointed to curtailment in energy use induced by giving households feedback on their energy consumption (Allcott and Mullainathan, 2010; Allcott and Rogers, 2014; Costa and Kahn, 2013; Dolan and Metcalfe, 2013), retrofitting is the more effective, according to engineering models (Dietz et al., 2009; Gardner and Stern, 2008) and randomized control trials (RCT).[1] But retrofitting is rare: it is difficult to induce households to modify their property. Even when the monetary and non-monetary costs of installing energy efficient technologies are heavily reduced, few households retrofit (Allcott and Rogers, 2014; Fowlie et al., 2015a). Here we test whether retrofitting was induced by the requirement that homes offered for sale or rent in England display an Energy Performance Certificate (henceforth, EPC requirement).

The contribution of this research is that it demonstrates a causal effect of energy labeling on investment in energy-saving technologies. Moreover, the observed effect cannot be accounted for by monetary incentives alone, and so our research sheds light on some non-monetary

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[1] The Weatherization Assistance Program, which retrofitted the homes of low income households, generated reductions of 7–8% in all forms of energy consumption (Fowlie et al., 2015b; Graff Zivin and Novan, 2015). The curtailment induced by the Opower study, which treated households with feedback on their electricity consumption relative to neighbors, generated 2% reductions in household electricity consumption only (Allcott and Rogers, 2014).

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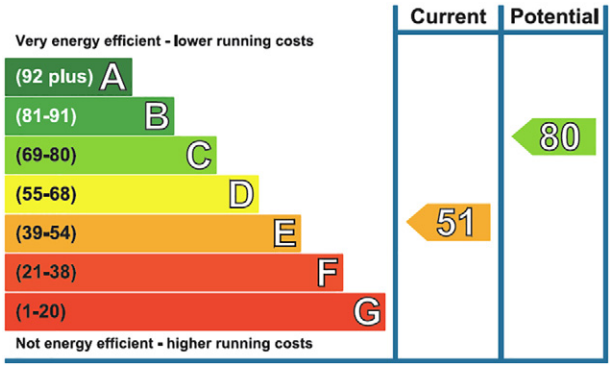

Fig. 1. An English Energy Performance Certificate, showing SAP score (51) and letter grade (E).

costs and benefits that influence the retrofitting decision. The explanation that best fits the observed effect is that investment is motivated by the goal to boost a home's energy rating to an arbitrary, though salient, reference point: the next color-coded letter grade on the visual display of the EPC. A sample EPC is presented in Fig. 1. Our explanation is consistent with results showing that consumers selectively attend to more salient attributes at the expense of more diagnostic attributes (e.g. Gabaix and Laibson, 2006; Lacetera et al., 2012; Englmaier et al., forthcoming).

Our identification strategy in this study is to look to a sample for which a marginal investment in energy efficiency will have particularly large positive impacts on the *appearance* of the resultant EPC. The English EPC reports home energy efficiency as both a 0–100 Standard Assessment Procedure (SAP) score and a concomitant color-coded letter grade (A green – G red). Previous research on selling prices in the English housing market has found that buildings with higher color-letter grades on the EPC enjoy a price premium (Fuerst et al., 2015). At certain initial SAP scores, a small investment in energy efficient technologies would shift a property into a higher color-coded letter grade on the EPC. We predict that some vendors will have invested in just enough energy efficiency so as to reach the next letter-grade. The testable implication is that, after the EPC requirement comes into effect, we will see a cluster of homes at the lowest point in a color-coded letter-grade.

To test for these clusters, we use data from the English House Condition Survey, which from 2002 onwards recorded SAP scores. We find a significant cluster at the lowest point in the D color-letter grade (55 SAP points) in the post-EPC data, but no cluster at this point in the distribution in the pre-EPC data. We rule out that this cluster was induced by planning requirements or that it was driven by new-build homes. We also replicate it in an independent sample. Additionally, when we restrict the sample to homes that had been treated by the EPC requirement – homes which had been traded since the EPC requirement – we find that this cluster is three-times as large and that there is a concomitant deficit of homes at the highest point in the E color-letter grade.

In the next section we present the background to our analysis. Section 3 reports our methods. Section 4 presents results. Section 5 discusses these results, paying particular attention to the question whether gaming could explain the observed clusters. We conclude that the EPC requirement prompted home vendors to make marginal investments so as to shift their homes to 55 SAP points. A necessarily crude but conservative back-of-the-envelope analysis of the cost savings induced by these marginal investments calculates them at £11.4 m per annum.

2. Background

2.1. Prior research on inducing retrofitting

Despite its high expected benefits to both the private household and to society at large, retrofitting is a behavior that has proven difficult to induce. Fowlie et al. (2015a) report the results of a resource-intensive RCT in which 7000 households, which were eligible for the Weatherization Assistance Program, were treated to an in-person visit by a field worker from their own community who explained the benefits of a retrofit of their heating and cooling infrastructure, explained that the retrofit would be free of charge and offered to help the household complete the paperwork to apply for the Weatherization Assistance Program. The campaign did increase uptake of Weatherization relative to a control group, but only to 6% of eligible households, and at a cost of over $1000 per weatherized home.

Qualitatively similar results come from the Opower RCT. Though the Opower RCT is justifiably cited as a success story in reducing energy consumption (e.g. Allcott and Mullainathan, 2010; Allcott and Rogers, 2014; Costa and Kahn, 2013), it was not successful at inducing retrofitting. Opower offered all their customers rebates on certain energy efficient purchases, e.g. $50–$75 for a washing machine; up to $5000 for home insulation. Additionally, households in the treatment group of the Opower RCT were sent bills that delivered feedback on their energy use and tailored recommendations on how to reduce energy consumption. For example, a household that consumes electricity heavily in summer would be shown the potential cost savings afforded by a new air conditioning unit. We know that this treatment group was motivated to reduce energy consumption because the results of the RCT show that they did reduce energy consumption through curtailment. Despite their motivation, the tailored information, and the offer of rebates, only 4.8% of them (compared to 4.4% in the control group) claimed rebates on energy efficient purchases (Allcott and Rogers, 2014).

Additional evidence of the stubbornness of retrofitting comes from the failure of the *Green Deal* in the UK. The *Green Deal* set aside £540 m in public money as loans to private households toward retrofitting (Palmer, 2015). It was designed in consultation with the Behavioral Insights Team (BIT) and was intended to overcome loss aversion by allowing participants repay the loan out of savings on their energy bills. Notwithstanding its behaviourally-informed design, the scheme was scrapped in 2015 due to lack of interest. In short, there is uncertainty regarding how to reduce the non-monetary costs that inhibit investment in energy efficient technology.

2.2. The EPC requirement

A 2002 directive from the European Union (EU directive 2002/91/EC) required member states to ensure (1) certification of a building's energy performance, (2) that EPCs are made available when a building is constructed, sold, or rented, and (3) that these EPCs are comparable across member states. In the UK, this directive was passed into law through the Housing Act of 2004. Specifically, the law requires that, prior to a property being placed on the market, it is audited for energy efficiency. The vendor or lessor is obliged to show the resultant EPC to potential buyers or renters. In practice, EPC's tend to be included in advertising material for the property.

The EU Energy Label, codified in EU Directive 92/75/EC, is the presentation format that was adopted for the EPCs (for an example, see Fig. 1). Crucial to this analysis, the UK grafted the 7 color-letter grades of the EU Energy Label on top of the UK's pre-existing measure of energy efficiency, the SAP score. Each letter-grade on the EPC spans a dozen or so SAP scores, so for example SAP scores from 39 to 54 are E grade (orange), and those from 55 to 68 are D grade (yellow).

The SAP score was developed in 1992 by the Building Research Establishment (BRE - at that time a government-funded research laboratory) to help the UK government monitor progress in residential energy efficiency. The SAP score measures "how much energy a dwelling will consume, when delivering a defined level of comfort and service provision" in terms of space heating, water-heating and lighting (Department of Energy and Climate Change, 2013). The SAP score is calculated based on a standardized audit of the building's fabric and