

HOME ENERGY AUDITS: WHAT CAN WE LEARN FROM A FIELD EXPERIMENT?

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Overview

The ability to take optimal decisions with respect to the investment in energy-using durables has implications on household finances. A recent literature has documented that, even though many investments in energy-efficient electric appliances, heating systems or in energy-efficient home renovations ensure net savings over their lifetime, households often fail to make these investments (Allcott and Taubinsky, 2015). This phenomenon is referred to as the energy efficiency gap in the academic literature (Jaffe and Stavins, 1994). Several studies have found a large potential for energy efficiency improvements in households (among others McKinsey & Company, 2009; Filippini and Hunt, 2011; Alberini and Filippini, 2018). As potential determinants of the energy efficiency gap, the literature discusses various market and behavioral anomalies (Broberg and Kazukauskas, 2015; Gillingham and Palmer, 2014). One of the barriers that are typically mentioned in the literature is limited information. If consumers take energy-related investment decisions under imperfect information on the level of energy efficiency, they might underinvest in energy efficient technologies (Gillingham and Palmer 2014). Most of the empirical studies confirm that a lack of information leads to underinvestment in energy efficiency (Ward et al., 2011; Newell and Siikamäki, 2014; Davis and Metcalf, 2016; Houde, 2018). However, few recent studies do not find that information affects investment decisions (Allcott and Sweeney, 2016; Allcott and Greenstone, 2017; Allcott and Knittle, 2019). Other authors highlighted the importance of a lack of cognitive skills and knowledge as barriers to energy-efficient investments (Blasch et al., 2017; Brent and Ward, 2018).

In this paper, we focus on the role of limited energy-specific knowledge that is needed to take investment decisions for the purchase of energy-consuming durables as a barrier to energy efficiency. In particular, we explore whether information treatments affect the consumers' valuation of energy efficiency, with consequences on both the decisions of replacement of home appliances and lighting, and the level of energy efficiency of the newly purchased durables.

To answer this question, we conducted a randomized field experiment to investigate the effect of tailored information provision on the consumers' decisions with respect to the purchase of energy-consuming durables. Using in-home visits, we collect detailed information on the level of energy efficiency of the participants' existing home appliances and lighting, and then provide information on the potential of savings from the replacement of these durables with energy efficient ones. We find a substantial response of households to our information treatment. The information provision increased both the replacement of existing light bulbs as well as the energy efficiency of the new light bulbs purchased.

This paper is closely related to a growing body of literature that studies the determinants of consumers' undervaluation of energy efficiency (among others Allcott and Knittle, 2019; Houde, 2018; Davis and Metcalf, 2015; Davis, Fuchs and Gertler, 2014; Newell and Siikamäki, 2014). We contribute to this literature by conducting an RCT that explicitly addresses households' actual decisions with respect to the purchase of the major home appliances, and allows to isolate the impact of the information treatment on households' decisions.

Methods

We administer a randomized control trial in collaboration with two local utilities in Switzerland (Aziende Industriali di Lugano and Stadtwerk Winterthur). Table 1 reports a sketch of the experimental design. A subgroup of customers of these two utilities has been randomly allocated to a treatment and a control group. In 2017, we sent a letter with an invitation to take part to a baseline survey with questions about demographic characteristics as well as energy-related knowledge to the customers allocated to the treatment group. At the end of the survey, the participants have been offered to receive a free basic in-home energy audit about the energy efficiency of the major home appliances and lighting. During an in-home visit, we collected information on the nameplate of existing major appliances (fridge, separate freezer, dishwasher, washing machine and clothes dryer) as well as lighting. We used the information collected during the in-home audits to recover data on the energy efficiency of the existing appliances of the participants. For each appliance, we then collected information about a comparable new appliance available on the market at the time of the audit which satisfies high energy efficiency standards (energy label A++ and A+++). The

information collected this way were used to compute the appliance-specific potential of saving coming from the adoption of a new energy efficient appliance.

The treatment group received information about the potential of savings coming from the replacement of their existing home appliances with energy efficient ones and from the purchase of energy efficient light bulbs. This consisted of two parts: (i) in February 2018, we sent them a letter via regular mail with a brief report of the energy audit; (ii) in June 2018, we sent an email offering them to access a website with similar information to that included in the report sent via regular mail. All participants in the treatment group received both the letter and the invitation to access the website. The information provided through the website was similar to that included in the letter sent via regular mail, with the difference that the information about the potential of saving coming from the adoption of a new energy efficient appliance was based on the intensity of usage of each appliance selected by the participants.

No customer of the utilities allocated to the control group was contacted with reference to the research project in 2017. In 2018, the same selection process has been implemented for the customers in the control group: they received an invitation letter to take the baseline survey followed by an invitation to receive the in-home visit. During the in-home visit, participants in the control group have been asked about the decisions of purchase of energy-consuming durables taken in the previous year. While the in-home visits were conducted, in 2018 we carried out a follow-up survey asking the participants in treatment group about their decisions of purchase following the information treatment.

We exploit the experimental design to compare the decisions of purchase of treated and control group following the information treatment, controlling for possible compositional differences and heterogeneity in the pre-treatment behaviour.

Table 1: Experimental design and group sizes.

	T=0 (2017)		T=1 (2018)	
Treated	Baseline survey In-home visit Information treatment	N=1,106 N=510 N=510	Follow-up survey	N= 442
Control			Baseline survey In-home visit Survey on past purchases	N= 424 N= 219 N= 219

Preliminary Results

As shown in Table 2, our preliminary results show a significant impact of the information provision on the probability to purchase new light bulbs. Moreover, we find households in the treatment group to have a higher probability to purchase more energy efficient light bulbs than households in the control group.

Table 2: Impact of information provision on light bulbs purchase.

	<i>Marginal effects</i>	
	Purchase of light bulbs	Purchase of energy-efficient light bulbs
treatment	0.0785** (0.0382)	0.1273*** (0.0397)
No. of observations	584	584

*Notes: Standard errors are reported in parentheses. ***/**/* indicate statistical significance at the 10, 5, and 1 percent level, respectively. We estimate a probit model, controlling for socio-economic characteristics of the households (such as age, education and income) and dwelling characteristics.*

Conclusions

The preliminary results do show a positive and significant impact of the information treatment on the purchase of light bulbs and the level of energy efficiency of the newly purchased bulbs. These preliminary results provide novel experimental evidence about the role of lack-of information on the consumers' valuation of energy efficiency, with relevant consequences in terms of the quality of their decision making. Ongoing research is focusing on the consolidation of the information about the energy efficiency of the existing home appliances of the households in the control group and that of the appliances purchased by the treatment group. In this paper, we will also analyse the impact of information provision on the replacement of old appliances and the level of energy efficiency of the newly purchased ones.