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Analysis

How Do Different Designs of Energy Labels Influence Purchases of Household Appliances? A Field Study in Switzerland

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ABSTRACT

Energy labels are a key element of energy efficiency policies. They provide information on appliances' energy consumption and aim at increasing consumers' attention to this characteristic. A well-known example is the EU Energy Label, which is required by law to be displayed on most energy-using durables in the EU as well as in Switzerland. In cooperation with a large online retailer in Switzerland we assess the impact of the EU Energy Label and of a newly designed monetary lifetime-oriented energy label in the field. We analyze private purchases of household appliances, especially freezers, vacuum cleaners and tumble dryers. We find that the display of any of the two energy labels increases the sales proportion of energy-efficient appliances compared to the absence of any energy label. At the same time, we observe a volume-effect for freezers: The average size of purchased freezers is larger when any of the two energy labels is displayed compared to the absence of any energy label. The influence of the two different energy labels is similar except for vacuum cleaners, for which monetary information might have an adverse effect.

1. Introduction

Since the 1970s, mandatory comparative energy labels have been introduced in various parts of the world as a key element of energy efficiency policies (Wiel and McMahon, 2005). Energy labels are expected to influence consumers' decision processes in two different ways. On the one hand, energy labels provide information on the energy consumption of appliances. Without a label, the respective information might not be perceived or considered by consumers because it is difficult or costly to obtain. Energy labels can be seen as means to resolve the market failure (Brown, 2004). On the other hand, energy labels can also help to overcome behavioral barriers to the choice of energy-efficient appliances, such as limited attention to the energy consumption of appliances or limited cognitive capacities (Anderson and Claxton, 1982; Bull, 2012; Gabaix and Laibson, 2006). Different energy labels vary in the way how they display the information. Most of them use scales, sliders, colors, etc. to facilitate the comparison of different appliances. The visual augmentation of energy labels may make the energy consumption information more salient for consumers and hence reduce the cognitive load to process the information (Hille et al., 2017). Hereby, the behavioral barriers can be overcome.

Energy labels matter since imperfect information and limited attention to the energy consumption and the lifetime costs of appliances had been identified as two main barriers to the purchase of energy-efficient appliances (Allcott and Greenstone, 2012; Gerarden et al., 2015; Gillingham and Palmer, 2014; Stadelmann, 2017). These barriers seem to keep consumers from taking advantage of cost-effective energy-conserving opportunities, i.e. they create an “energy efficiency gap” (Brown, 2004; Hirst and Brown, 1990)[1]. Energy labels and especially visually augmented ones address both the information and the attention deficit of consumers (Bull, 2012). Consumers can be expected to buy more products with low energy consumption by incorporating previously unknown or non-salient information on the energy consumption of products (Davis and Metcalf, 2016; Ungemach et al., 2017). Hence, energy labels tend to increase the share of purchases of energy-efficient appliances. Energy labels help consumers make better purchase decisions for themselves (i.e. incurring lower lifetime costs) and for society (i.e. creating less energy consumption with the implication of less negative externalities like, for instance, global warming).

Wiel and McMahon (2005) distinguish between (voluntary) *endorsement labels* (e.g. Energy Star) as “seals of approval” and (mandatory) *comparative labels* (e.g. EnergyGuide, EU Energy Label) with

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[1] In the context of purchases of household appliances, an energy efficiency gap implies that consumers purchase an energy-inefficient appliance with higher total costs (purchase price plus discounted lifetime energy costs) than a more energy-efficient alternative.

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specific information on energy consumption. The latter type of labels allows for comparing similar products on either discrete or continuous scales.[2] In this paper, we focus on the influence of different designs of comparative labels on purchases of household appliances.

Numerous studies are analyzing the impact of different designs of comparative energy labels, most of which are based on hypothetical choice experiments. Starting with McNeill and Wilkie (1979) and Hutton and Wilkie (1980), a large stream of literature analyzed the effects of monetary units versus physical units incorporated in energy labels. Furthermore, the impact of using different scales (e.g. monthly, yearly, 10 years, life-cycle) when communicating (electricity) consumption has been analyzed (see, e.g., Allcott and Sweeney, 2017; Allcott and Knittel, 2017, Allcott and Taubinsky, 2015; Anderson and Claxton, 1982; Blasch et al., 2016; Bull, 2012; Camilleri and Larrick, 2014; Carroll et al., 2016; DECC, 2014; Deutsch, 2010a,b; Dumortier et al., 2015; Hardisty et al., 2017; Heinzle, 2012; Kallbekken et al., 2013; Min et al., 2014, and Newell and Siikamäki, 2014). Rohling and Schubert (2013) and Kaenzig and Wüstenhagen (2010) reviewed the earlier studies to show that the communication of electricity consumption in monetary units over product lifetime seems to increase the willingness-to-pay for energy efficiency as compared to physical units for one year. According to Camilleri and Larrick (2014), presenting electricity consumption information in monetary units and on expanded scales lowers the cognitive burden of consumers and enables them to make better decisions to achieve their personal goals, such as minimizing their long-term costs (Hardisty et al., 2017).

Another stream of hypothetical choice experiments is concerned with the impact of the EU Energy Label, which presents the information on appliances' energy consumption in physical units (kWh) and a categorical rating scale for appliances' energy efficiency classes (see Section 2.2 for details on the design of the EU Energy Label). In general, these studies explain the effectiveness of the EU Energy Label by its categorical, colored, and alphabetical rating scale for an appliance's energy efficiency class. Andor et al. (2017) found that a majority of consumers values the energy efficiency classes per se: They are willing to pay at least 30 EUR for a better efficiency class even if the difference in electricity use and hence the difference in electricity costs is only marginal. In an eye-tracking study, Waechter et al. (2015a) showed that consumers focus on the energy efficiency class and disregard information on an appliance's expected electricity consumption in kWh. The authors argue that this could cause a misleading effect of the EU Energy Label if product size is a considerable driver of electricity use (as for example for cooling appliances, televisions, or automobiles): Consumers judge an appliance only based on the energy efficiency class despite size-related differences in electricity consumption (kWh). This effect is called the “energy efficiency fallacy” (Waechter et al., 2015a,b). Hille et al. (2017) demonstrated that the energy efficiency fallacy is particularly driven by the vivid visual representation (i.e. the colored alphabetical scale) of the energy efficiency class. Other studies found that consumers perceive the energy efficiency of products as being more similar if the labels of the rating scale levels share similar or identical linguistic or visual characteristics, such as the A+, A++ and A+++ added to the original EU energy efficiency classes (Heinzle and Wüstenhagen, 2012; Meissner et al., 2013; Ölander and Thogersen, 2014). If appliances in the higher energy efficiency classes are perceived as rather similar, consumers' willingness-to-pay for energy efficiency is reduced compared to a linguistically consistent rating scale from top to bottom, such as “A to G”. Waechter et al. (2016) show that the willingness-to-pay for the most efficient appliances is also reduced by the fact that the rating scale always covers seven energy efficiency classes, even if the availability of products is reduced to fewer classes, e.g. because of minimum efficiency standards.

[2] See Rohling and Schubert (2013) for an overview of energy labels for household appliances.

Field evidence on the effect of energy labels on *actual purchase decisions* is sparse. In the first field experiment including variations of a visually augmented energy label for household appliances, Anderson and Claxton (1982) found that energy labeling increased the energy efficiency of small refrigerators sold, but there was no difference between kilowatt hour labels and annual dollar cost labels. Allcott and Knittel (2017) and Allcott and Taubinsky (2015) presented consumers with electricity cost information in their information treatment messages and found no effects of information disclosure on actual purchase decisions. Carroll et al. (2016), DECC (2014), Hardisty et al. (2017), and Kallbekken et al. (2013) examined the effect of adding multi-year electricity cost information to product labels on actual purchase decisions.[3] Among the aforementioned four field experiments, Hardisty et al. (2017) present the most robust results: Higher proportions of energy-efficient furnaces, light bulbs, TVs, and vacuum cleaners were chosen when 10-year electricity costs were displayed. DECC (2014) found that the presentation of lifetime electricity costs significantly reduced the mean expected annual electricity consumption of purchased washer dryers, while no significant effect was observed for tumble dryers and washing machines.[4] Carroll et al. (2016) observed a reduction in the mean expected electricity consumption of purchased tumble dryers due to electricity cost labeling, but the effect was not statistically significant. Similarly, Kallbekken et al. (2013) found that without the advice of trained sales staff, the lifetime electricity cost information had no statistically significant effect.

To our knowledge, there is no experimental study analyzing the influence of the EU Energy Label on *actual purchase decisions*.[5] In our study, we take advantage of the fact that the image of the EU Energy Label is absent in most Swiss online shops. Hence, we were able to study the effect of displaying the EU Energy Label in a Swiss online shop on actual purchases. Furthermore, we compare the effect of the EU Energy Label with the effect of a newly designed energy label focusing on monetary and lifetime-oriented information. This might be seen as an addition to the handful of promising field experiments in this area.

We examined the impacts of the two visually augmented energy labels on actual purchases of freezers, vacuum cleaners, and tumble dryers over a period of 9 months. We found that the presence of either energy label led to an increase in the sales proportion of energy-efficient appliances compared to not displaying any energy label. The effectiveness of the EU Energy Label and of the monetary lifetime-oriented energy label proved to be similar for appliances with rather high electricity costs, i.e. freezers and tumble dryers. For freezers, we additionally observed an increase in mean volume of purchased appliances with the display of both energy labels, offsetting any reduction in expected annual electricity consumption from the increase in energy efficiency. For vacuum cleaners, we found that the monetary lifetime-oriented energy label was less effective than the EU Energy Label in increasing the purchase share of energy-efficient appliances. One possible explanation is that the monetary lifetime-oriented label increased consumers' attention to the low absolute electricity costs of vacuum cleaners. Another explanation might be that the EU Energy Label was particularly effective for vacuum cleaners, for which the scale of energy efficiency classes covers the original range from A to G and appliances were for sale in each energy efficiency class (see Heinzle and

[3] In each study, the EU Energy Label of the products was unaltered. While Carroll et al. (2016) (5-year electricity costs) and Kallbekken et al. (2013) (lifetime electricity costs) created additional energy cost labels, DECC (2014) (lifetime electricity costs) and Hardisty et al. (2017) (10-year electricity costs) simply added the information at the bottom of the existing appliance label, which was not very salient.

[4] The result that an effect was observed for washer dryers was explained with the fact that their lifetime running costs were the highest out of all the product types in the trial.

[5] There is also no clean observational study for the influence of the EU Energy Label at the time of its introduction. The introduction of the EU Energy Label was generally combined with an undertaking by retailers to offer more high-efficiency appliances and to train their retail staff on energy efficiency issues, which prevented the identification of the effect of the label on its own (Bertoldi, 1996).

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