Do Electronic Home Energy Reports Promote Energy Conservation? It Depends

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Overview

A large number of studies have shown that social norms affect people's choices and induce people to save energy (see e.g. Schultz et al., 2007; Nolan et al., 2008; Brent et al., 2015). Home energy reports (HER), which are either sent to private households by post or electronically via e-mail, provide households with energy conservation tips and social norm information by comparing a household's energy use to that of similar neighbors. As a result of regularly being exposed to neighbor comparisons via HER, households are expected to reduce their energy consumption. Although HER have been found to reduce electricity consumption (see e.g. Allcott, 2011; Allcott and Rogers, 2014), recent research from Germany suggests that HER sent by post might not be cost-effective in Europe, as the required treatment effects would need to be much larger in European countries than in the US (Andor et al., 2020).

Whereas electronic HER have lower intervention costs than letter-based HER and may thus increase cost effectiveness, their potential in terms of achieved consumption reductions may be lower as electronic HER are likely to be less obtrusive than letter-based HER. Given the mixed findings for the effect of electronic HER (Byrne et al., 2018; Henry et al., 2019) and the lack of evidence for the effect of electronic HER in a European country, this paper evaluates the effect of electronic HER on household electricity consumption in Austria.

To this end, we draw on consumption data elicited during a randomized controlled trial (RCT) with about 22,000 customers from an eco-electricity provider in Austria between 2013 and 2016. Our main specification suggests that electronic HER do not significantly affect electricity consumption for our Austrian sample households. Yet, we find evidence for a substantial boomerang effect that differentiates responses according to whether the treated household's electricity consumption is above or below the average consumption of households in their zip code. Those households whose consumption is below the mean of the zip code significantly increase their consumption, while those whose consumption is above the mean of the zip code decrease their consumption.

Methods

We employ a difference-in-differences (DiD) estimator to determine the average treatment effect (ATE) of HER on electricity consumption:

$$y_{it} = \beta\, T_i P_t + \gamma\, P_t + \tau_w + \alpha_i + \varepsilon_{it},$$

where T_i is an indicator variable for the treatment group, P_t the treatment period indicator and β the coefficient of interest that captures the average effect of being treated with HER on the daily electricity consumption. We include weekly dummies, τ_w , for both the baseline and final billing period to account for seasonality, α_i designates household fixed effects and ε_{it} denotes an idiosyncratic error term.

Since the HER were sent as e-mail to all treatment households on the same dates, but the final billing periods started and ended at differing dates for individual households, treated households received a varying number of mails in the final billing period. Hence, defining the treatment variable T_i as a dummy variable equaling unity if a household is assigned to treatment and zero otherwise only allows us to measure an intent-to-treat (ITT) effect. We take advantage of this by exploiting a variety of treatment definitions, each capturing the treatment intensity and effect heterogeneity of individual mails. For instance, in our preferred specification, we define a continuous treatment variable T_i capturing the treatment intensity by only equaling unity if a household receives all four mails within the final billing period and otherwise equaling the overlap of the treatment period (equaling 365 days starting with the first mail) with the final billing period. With this definition we are able to estimate an ATE.

Results

With a small and statistically insignificant coefficient of 0.036 on our continuous treatment variable, the results of the DiD regression suggest that electronic HER do not affect electricity consumption for our sample households. To better understand how our social comparison-based HER work, we test whether our sample households display heterogeneous responses to receiving electronic HER. As treated households in our sample received a comparison of their own baseline consumption with the average consumption of households in their zip code, we are interested in whether this information evokes different behavior depending on whether a household's consumption lies above or below the zip code level. To this end, we interact the continuous treatment variable with a dummy variable indicating whether a household's consumption lies above or below the average zip code consumption. Our results strongly indicate a boomerang effect: Households whose baseline consumption figure lies below the average consumption in the zip code they live in are found to significantly increase their daily consumption by about 0.453 kWh (~5%) after receiving electronic HER. On the other hand, households whose baseline consumption figure lies above the average are found to significantly decrease their daily consumption by about 0.598 kWh (~6.5%)

Conclusions

This study examines changes in household's electricity consumption following the receipt of electronic home energy reports (HER). Based on an RCT in Austria, our results indicate that on average, electronic HER do not lead to significant changes in electricity consumption of Austrian households. Given the recent findings by Andor et al. (2020), which point out that effect sizes are too small to make HER a cost-effective instrument to reduce household consumption in Germany, our null-results seem to support this finding despite looking at cheaper, electronic HER. However, further analyses reveal a strong heterogeneity in the treatment effect: Households with high baseline consumption levels significantly decrease their consumption, and effect sizes are substantial and as high or even higher than found for the US. Yet, this positive effect comes at the cost of a significant increase in consumption of low-consumption households. Hence, our findings imply that targeting electronic HER to high-consumption households may be a cost-effective instrument to induce substantial energy savings for certain households. An important qualification of our study is its focus on eco-electricity customers: As these households are likely to be more environmentally friendly than customers of a conventional energy utility, the social comparison for households that consume less than the zip code average may induce a feeling of "already doing more than enough" to save energy and protect the environment and therefore, to feel legitimized to increase their consumption. The focus on customers of an eco-electricity provider may also explain the large effect size that we find for customers whose consumption lies above the average zip code consumption level.

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