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THE EFFECT OF INFORMATION NUDGES ON ENERGY SAVING: OBSERVATIONS FROM A RANDOMIZED FIELD EXPERIMENT IN FINLAND

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1. Introduction

Electricity remains a relatively poorly understood area of spending among households [1], and households are likely to miss out on potential energy savings. This is where information related behavioural interventions can have a meaningful role. Successful trials [2,3,4] have shown the potential of behavioural interventions to induce electricity saving.

Finland is different from most of the previously studied areas due to its northern location and being a part of the Nordic energy market with 100 % smart meter deployment. This study evaluates the effectiveness of information nudges on residential electricity consumption among Finnish households. We conducted a randomized field experiment to study whether i) email energy saving letters, ii) an online energy service platform, and iii) a provision constantly updating comparative electricity consumption information (i.e. social norm) influence households' electricity consumption.

The impacts of information treatments have been studied extensively and estimated effect size varies from 2% to over 7% with more robust results showing savings from 2-4% [5,6]. The effects are context specific [7], and the interventions vary in their scalability. This study contributes to the existing research with an experimental setting, which allows for analysing the treatment effects between users and non-users of an online energy service

platform. No randomized field experiments on information nudges have been conducted in Finland before and generally we lack knowledge on the topic in the distinct Nordic climate conditions with high seasonal variation in the energy consumption. The intervention employed emails and an online service as channels for the information provision. These solutions are highly scalable and have not been studied as extensively [8].

2. Methodology

The experiment was conducted among customers of Porvoon Energia, a large electricity distributor in Southern Finland. Participants were acquired through an online survey in which 671 households agreed to participate in the experiment through the opt-in question partly required by the GDPR. All experiment participants could sign-up to access their electricity consumption data via online energy service platform, but not everyone use this opportunity. Within signed-up i.e. registered users (R), we randomized the participant sample (N=393) into: i) energy saving tip treatment (Tip-R), ii) social norm plus reduced energy saving tip treatment (Norm-R), and iii) control (Control-R). Those who had not registered (NR) (N=298) were randomized into: i) energy saving tip treatment (Tip-NR), and ii) control (Control-NR).

The experiment itself was conducted between November 2018 and December 2019. Information was administered via monthly e-mail newsletters that included tailored energy saving tips for Tip-R and Tip-NR, simplified energy saving tips for Norm-R, reminders to check the electricity consumption from the online service platform for Tip-R and Norm-R, reminders to use the online peer comparison tool in the online service developed for Norm-R, and instructions on how to register to the online service for Tip-NR. The newsletters were sent every month except in July because of the summer holiday period in Finland.

To estimate the effect of randomised nudges on household's daily electricity consumption, we use a difference-in-difference (DiD) model:

$$\ln(kWh_{it}) = \alpha + \beta T_i P_t + \tau T_i + \gamma P_t + \mu \Omega + \varepsilon_{it},$$

where Ω refers to household characteristics such as income, household size and education, home characteristics such as floor area, house type and heating system, and weather factors temperature and rainfall. We study an intent-to-treat effect since not all treatment (T_i) households necessarily engage with the newsletters and online peer comparison tool. The key DiD assumption of common pre-treatment trends between the treatment and control groups is valid.

3. Results and Findings

We find no statistically significant treatment effects on electricity consumption for the Tip-R, Norm-R, and Tip-NR groups over the yearly treatment period. However, when the overall treatment period is divided into monthly periods capturing the seasonal changes in Finland, we observe impacts across the treated groups. The Tip-R group receiving detailed energy saving tips responded to the treatment by decreasing the electricity consumption by approximately 10% in the beginning (between November 23rd and March 31st). However, in the following 7 months, we observe the effect disappear. Later, a statistically significant reduction of 8,3% is present in November, the last month of the experiment.

The Norm-R group receiving simplified energy saving tips and access to the peer comparison tool does not show a statistically significant response to the treatment during the experiment. Only at the end of the experiment, in November, we observe a significant decrease in electricity consumption by 7,9%. These findings could be explained by the low usage of the comparison tool and partially by the changes we made to the content of the energy saving tips towards the end of the experiment. The newsletter was made more detailed for the Norm-R group as well compared to the previous periods. The response in the last period could indicate that it is necessary to also provide the detailed energy saving tips together with the peer comparison tool to achieve any decrease in consumption. Or, in other words, the information provided by the peer comparison tool is not enough by itself to nudge the households to consume less electricity.

The Tip-NR group receiving the detailed energy saving tips, but who had not registered to the online energy service platform, did not show significant changes in their electricity consumption. This finding demonstrates that it may be difficult to encourage energy conservation behaviour when the target group is less interested in information of their energy usage to start with.

4. Discussions and Conclusions

This paper examines how households living in the Nordic climate conditions with a high seasonal variation in the temperature and energy consumption respond to energy saving tips and peer comparisons. The results show reduction in electricity usage during the winter months within the groups of already registered users of the energy company's online service. These are households who have expressed interest in getting information related to their own electricity consumption even before the experiment. Conversely, the findings also imply challenges in encouraging energy saving behaviour within the non-registered group of households, for whom the energy related issues might be of less interest. More information is required to identify the key drivers that could help activate these households.

The provided energy saving tips were extensive, but the effort required to extend the information nudging to new households, even with some personalised content, is minimal as the cost of sending emails is low. Well-planned informational content sent digitally could be a cost-effective way to encourage energy saving among households.

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