Households revealed willingness to pay during winter electricity shortages

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Abstract

The war in Ukraine has sparked a global energy crisis. Switzerland's energy supply is also affected. While the winter of 2022/23 was rather mild in Switzerland, this might not be the case for coming winters. Thus, we design and implement a field experiment, in which we want to test the revealed willingness to pay of households for their heat pump's energy consumption during winter electricity shortages with relatively extreme electricity prices. The experiment will be implemented in cooperation with a Swiss utility, that invites their residential customers with heat pumps to participate to the study. Our intervention provides treated households with weekly high price signals, the households then decide whether to pay these high prices (deduction form a virtual study budget) or to curtail their heat pump's consumption and avoid some part of the high energy costs.

Data Analysis Plan

We use a randomized control trial design. Random assignment of participants to the treatment forces the selection bias to be zero. In addition, randomization has the effect that the treatment and control group will tend to be similar along all characteristics, including the potential outcomes under the control condition. As a result the difference in means of outcome variables between the treatment and control group gives the treatment effect (Angrist & Pischke, 2009).

To evaluate the effects of the treatment, we combined data from the baseline household survey, the smart meter data provided by the utility, and the follow-up survey. We suggest the following workflow for the data analysis:

1) Descriptive statistics: Analyse outcome variables, socio-economic variables as well as other possible explanatory variables.
2) Check outcome variable (especially heat pump consumption) for their distributions. Outcomes we measure are twofold:

(i) heat pumps electricity consumption and

(ii) self-reported change of heating settings (elicited in the follow-up survey).

3) Balance check on observables: Do treatment and control group really have the same characteristics?

4) Estimate the treatment effects:

(i) Dichotomous treatment (between subjects)

- Difference in means of outcome variables between the treatment and control group (Duflo et al., 2007).

- Regressions with explanatory factors (Angrist & Pischke, 2009, p.23).

(ii) Continuous treatment (within subjects)

- Exploit the variation of the price signals and the panel structure by using panel data regressions where the treatment is used as covariate.

Furthermore, we will analyse the stated preferences elicitation using discrete choice models such as probit or ligit regressions (Johnston et al., 2017; Miller et al., 2011). And finally, we will compare the results of the revealed preferences approach (treatment effects) with the results from the stated preferences approach.

References

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