



Master Thesis

An Empirical Estimation of Residential Electricity Demand Response to Dynamic Pricing

Historically, residential electricity customers were predominantly equipped with static contracts. Accordingly, they consumed electricity at a constant retail price and were not exposed to real-time fluctuations in wholesale electricity prices. Hence, there was no incentive to respond to real-time changes in wholesale electricity prices, resulting in rather inelastic apparent demand. By contrast, if residential customers were to observe a real-time price signal and adjust their demand accordingly, this could (i) relieve the energy system in situations of tight supply and (ii) generally lead to a more economically efficient equilibrium (Biggar & Hesamzadeh, 2014).

In a recent experiment in Norway, 3103 households were confronted with time-of-use (ToU) pricing contracts, while their hourly demand was tracked over a period of 4 months and published as a comprehensive open dataset (Hofmann & Siebenbrunner, 2023). A subsequent analysis of the data estimated that households reduce their electricity demand by an average of 2.92% during high-price periods (Hofmann & Lindberg, 2023a). In addition, another analysis found evidence that households reduce their energy consumption during periods of sustained high energy prices, such as most recently in the winter of 2021/2022 (Hofmann & Lindberg, 2023b).

As part of this thesis, a literature review shall summarize and discuss the main findings and methods applied in the existing Norwegian studies and put this into context with other research on dynamic pricing. The main section shall develop and conduct additional empirical analysis of the electricity demand response based on the Norwegian dataset that extends the existing literature. Potential analyses could focus on heterogeneous treatment effects by household type, region, or time. Furthermore, the dataset captures the type of electricity contracts for every household, irrespective of the experiment. Unlike the initial experiment, which examines ToU price signals, this could be used to analyze the households' response to real-time price variations. If possible and sensible, the Norwegian dataset may also be extended. Lastly, the student should discuss their results critically and against the findings obtained by previous research.

Key tasks and objectives of the thesis

- Reviewing empirical literature on the electricity demand response to variable prices
- Developing and conducting a novel empirical analysis based on an existing dataset

Your profile

- Student in Economics and general knowledge in the field of Energy Economics
- Knowledge of quantitative methods (empirical analysis) and implementation in statistical software programmes

Literature and Data set

- Biggar, D., Hesamzadeh, M.R., 2014. The Economics of Electricity Markets, 1st ed. John Wiley & Sons, Ltd.
- Hofmann, M., Lindberg, K.B., 2023a. Evidence of Households' Demand Flexibility in Response to Variable Electricity Prices – Results from a Comprehensive Field Experiment in Norway.
- Hofmann, M., Lindberg, K.B., 2023b. Residential Demand Response and Dynamic Electricity Contracts With Hourly Prices: A Study of Norwegian Households During the 2021/22 Energy Crisis.
- Hofmann, M., Siebenbrunner, T., 2023. A rich dataset of hourly residential electricity consumption data and survey answers from the iFlex dynamic pricing experiment. Data in Brief 50, 109571.

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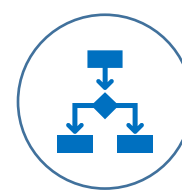
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Topics



- Demand response
- Price elasticity
- *Time of Use* and *Real-time* pricing

Methods



- Literature review
- Empirical analysis
- Panel Data