

APPLYING EXPERIMENTS TO AUCTIONS IN ELECTRICITY MARKETS

Friedrich KUNZ, Florian LEUTHOLD, Michael BAUMGÄRTNER, Hans-Christian SEELIGER, Linda STOLZE

Dresden University of Technology, Chair of Energy Economics and Public Sector Management,
01062 Dresden, Germany
friedrich.kunz@mailbox.tu-dresden.de

1. Overview

The present study examines bidding behavior on single sided uniform and pay-as-bid auctions taking into consideration risk averse and risk affine behavior of participating subjects. The Risk attitude is defined as chosen response to perception of significant uncertainty. The response is distinguished more exactly by examining diverse situations including ‘winning situations’ and ‘loosing situations’. Generally, experiments in experimental economics try to optimize results assuming that the participants are risk neutral and often contain disturbances which cannot be excluded as easily as gender or age. In reality subjects tend to have different attitudes concerning risk. For the time being, the risk attitude of participants has not been taken into account in the field of experimental economics for electricity markets.

2. Methods

We conducted experiments concentrating on pure risk averse and affine groups of participants and with a stable linear demand environment. The objects of investigation of our analysis are efficiency and prices. Optimal prices and resulting efficiency are considered as those that occur if participants offer their full capacities at marginal costs. Related to this, efficiency is defined as the ratio of achieved overall surplus to optimal overall surplus at optimal price. We compare achieved efficiency and prices within the different risk attitudes and with experiments in the literature. The supply curve used in the experiments was modeled based on the German energy market omitting imports and reduced to five different equipments for the participants whereas the demand was assumed as linear characterized by an elasticity and reference demand. The equipments consisting of three types of power plants differ regarding marginal costs and installed capacities. The participants are undergraduate students with economic background and selected related to their individual risk attitude. The determination of the individual risk attitude was carried out by a web-based test, which all participants had to take while registering for the experiments.

3. Results

The results show that risk behavior of the participants impacts on the results and influences prices and efficiency significantly. We show that risk averse participants tend to ask higher prices than risk affine

participants. More general results show that over all experiments average efficiency profits when playing with risk affine players. Regarding auctions types, average efficiency in terms of relative welfare is in the case of uniform auctions higher compared to the pay-as-bid auction, but on the other hand average prices are higher in the uniform auction. These results are partly contrary to other studies comparing uniform and pay-as-bid auctions.

4. Conclusions

Based on the experiments, we can conclude that a uniform auction conducted with risk averse or affine participants results in a higher average price level and a lower variance of the prices. On the other hand, the efficiency in the uniform auction is characterized by a higher efficiency and a lower variance compared to the pay-as-bid auction. Regarding the risk attitude, experiments with risk averse participants indicate on average a lower efficiency and a higher price level compared to the risk affine participants. It could be shown that the risk attitude of the participants affect the results regarding price and efficiency significantly. Hence, the risk attitude of participants should be taken into account for experimental approaches to analyze behavior in electricity markets.