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Behavioral aspects of regulation: A discussion on switching and demand response in Turkish electricity market

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HIGHLIGHTS

- Behavioral economics can provide insights for consumer' decisions.
- Switching and demand response behavior is examined by econometric methods.
- Results is consistent with the neoclassical literature to some extent
- However, behavioral factors are also affecting consumers' decisions.

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ABSTRACT

Electricity sector has been transformed from state-owned monopolistic utilities to competitive markets with an aim to promote incentives for improving efficiency, reducing costs and increasing service quality to customers. One of the cardinal assumptions of the liberalized and competitive electricity markets is the rational actor, and decision-makers are assumed to make the best decisions that maximize their utility. However, a vast literature on behavioral economics has shown the weakness of economic theory in explaining and predicting individuals' decision-making behavior. This issue is quite important for competition in electricity markets in which consumers' preferences have a significant role. Despite its importance, this issue has almost been neglected in Turkey, which has taken major steps in electricity sector restructuring. Therefore, this paper aims to examine switching and demand response behavior in Turkish electricity market by using multiple correspondence and panel data analysis, and findings are discussed in light of the neoclassical and behavioral economics literature. Analyses' results show that consumers' switching and demand response behavior is consistent with the neoclassical literature to some extent; however, behavioral factors are also affecting consumers' decisions. Furthermore, there are systemic problems that hinder effective functioning of the electricity market and restrict competition.

1. Introduction

Once functioned as state-owned and monopolistic utility, electricity sector has been transformed into competitive markets by liberalization and deregulation. One of the major aspects of new market structure is the interaction of various actors namely power generators, wholesalers and consumers in competitive market context. Contrary to the old structure, the new market design allows market actors to take the "best" decision in terms of utility-maximization. On the other hand, theoretical neoclassical models that depend on fully rational decision-maker who mathematically optimizes his utility under full-access to information have failed to explain some outcomes that have been observed in competitive markets. In this respect, economists have started to look for answers in other disciplines, mostly to psychology in understanding actors' *irrational*[2] decisions.

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[1] The views expressed here are those of the authors and do not necessarily represent the institutions they are affiliated with.

[2] Irrational behavior is used in this article as behaviors that conflict with the axioms and assumptions made in rational agent and utility theory.

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Even though the traditional literature has also focused on market imperfections and agent-based optimization constraints to explain inconsistent outcomes, it has failed to explain realized behavioral deviations from what mathematical models predict (Pollitt and Shaorshadze, 2013). Since 1950s, experiments on choice and decision-making have shown that individuals consistently show biases under uncertainty and risk, and certain outcomes are over-weighted compared to uncertain/risky outcomes. These biases have been observed in many cases, even in financial markets which satisfy competitive market assumptions far more than any other market. Therefore, behavioral approaches, that utilize psychology to understand why actors make *irrational* decisions, are mostly used to understand the motives underlying individual choices (Pesendorfer, 2006).

Policy makers and managers are also not immune from making *irrational* decisions; however, customers are more vulnerable to the outcomes of their decisions. In electricity markets, where many consumers do not understand the technical and economical complexities, it's more likely that they underestimate costs or benefits of their decisions. In addition, energy expenditures in many countries make only a small share of consumers' expenses; therefore, consumers may not even be aware of their gains or losses in the short-term. Moreover, many policies targeting at reducing greenhouse gases' emissions, increasing energy efficiency, promoting renewable energy technologies rely on consumers' and investors' response to incentives, costs and prices, and it has been suggested that prices and technology may not be the only reasons impeding diffusion of new technologies. In this respect, understanding how actors/customers evaluate options and make decisions rather than relying on *rational* decision maker assumption can contribute a lot in designing and implementing policies in competitive electricity markets.

Turkey has started its market liberalization with the enactment of Electricity Market Law in 2001, and has taken further steps in achieving a competitive and liberalized electricity market. With a growing economy, high energy demand growth and a large market with a population of almost 80 million, Turkey's electricity market has been a good example in understanding transition challenges to a competitive and liberalized electricity market. Meanwhile, Turkey has also set goals in promoting energy conservation and efficiency, reducing non-technical losses in electricity transmission and distribution, and promoting renewable energy investments. Most of these policy goals require consumers' response to incentives and penalties. While some of these policies have been successful, some policies have failed to meet the expectations, and understanding consumer behavior can contribute to better regulations and policies. On the other hand, discussion on this issue has been scarce so far in Turkey. To the best knowledge of the authors, only Gürbüz (2014) discussed eligible consumer behavior in Turkish electricity market (Gürbüz, 2014).

In this respect, this paper aims to examine consumers' decisions on demand response and supplier switching by using multiple correspondence analysis and panel data analysis, and discuss the findings in light of the neoclassical and behavioral economics literature. Section 2 presents an overview of major issues raised by behavioral economics, while Section 3 focuses on energy policy from behavioral economics perspective. Section 4 summarizes an overview of Turkish electricity market, and Section 5 explains methodology of this paper and analyses results are presented. Findings are discussed in Section 6 and Section 7 concludes the article.

2. Behavioral economics, rationality and irrational behavior

In a neoclassic economic model without market rigidities or imperfections, competition will optimize the agents' welfare as well as the social welfare. Rational actors described in these models aim to maximize their utility with given budgetary constraints, and their objectives are summarized in their preference structure. In such models, a preference structure is considered *rational* if it satisfies *completeness* and *transitivity* properties,[3] in other words, individual's preferences have to be well-defined and reflect the true costs and benefits of the available options (Camerer et al., 2003; Mas-Colell et al., 1995).

The second important aspect of economic theory is the expected utility theorem.[4] Contrary to certain outcomes, expected utility theorem models choice under uncertainty, and it is based on *rational behavior* axioms with additional *independence axiom* (Mas-Colell et al., 1995). With *continuity* and *independence axioms* satisfied, the *expected utility theorem* states that decision-maker's preferences are representable by a utility function with the expected utility form. In simpler words, individuals' choice under uncertainty can be modeled easily under rationality axioms (Mas-Colell et al., 1995).

However, these assumptions were criticized by two major lines of research, since they are claimed to be insufficient to represent the actual decision making behavior. The first major criticism was raised by Herbert A. Simon in his groundbreaking paper in 1955, and he initiated discussions on "bounded rationality" that will further be extended by other economists. In his paper, Simon questions the validity of the rational man in the traditional economic theory, and offers "aspiration level[5]" as a criteria in decision-making process contrary to optimization-seeking behavior (Simon, 1955).

The second major criticism was raised by cognitive psychologists that conducted experiments to identify "anomalies" in decision-making behavior (Camerer et al., 2003). Almost two decades after Simon's paper, Kahneman and Tversky's paper on the "Prospect Theory" in 1979 underlined significant weaknesses in rational behavior assumption (Kahneman and Tversky, 1979). The authors stressed that even though most people actually obey the axioms of the expected utility theorem, there are preferences that systematically violate these axioms. In response, these authors developed the "Prospect Theory" which has two phases in the choice process: An editing phase consists of a preliminary analysis of the offered prospects, which often yields a simpler representation of these prospects, and an evaluation phase in which edited prospects are evaluated and the prospect of highest value is chosen (Kahneman and Tversky, 1979).

These pioneering studies and further research have established a vast literature on behavioral economics and contributed to the understanding individuals' decision-making behavior in different contexts. Important aspects of the literature can be summarized under four points:

2.1. Bounded-rationality

Contrary to rational behavior assumption that individuals maximize subjective expected utility, individuals' decisions are affected by cognitive, environmental or psychological constraints, and they show non-optimizing behavior in their decisions (Selten, 2002). Instead of using sophisticated mathematical optimization

[3] In microeconomic theory, consumer preference theory has five axioms that are used to model rational behavior : a) Completeness, preferences are defined, b) Transitivity, preferences are consistent, c)Continuity, d)Non-satiation, consumer always places positive value on more consumption, e)Diminishing marginal utility and diminishing marginal rate of substitution (Mas-Colell et al., 1995).

[4] For a detailed description of the expected utility theorem see (Mas-Colell et al., 1995).

[5] Aspiration level can be defined as "a value of a goal variable that must be reached or surpassed by a satisfactory decision alternative" (Selten, 2002).