DEMAND RESPONSE: SMART MARKET DESIGNS FOR SMART CONSUMERS

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Overview

We study Peak-Time-Rebates (PTR) contracts in day-ahead electricity markets. Such contracts reward customers for reducing their consumption when wholesale prices are high. They are very popular among politicians and consumers' representatives because customers can only benefit from them, contrary to other instruments such as introducing high on-peak prices.

We first study the incentives PTR contracts provide to strategic consumers endowed with private information, and characterize the class of incentive compatible (IC) contracts. This exercise allows us to unify under a single analytical framework the various critics that have been formulated against PTR contracts.

IC contracts do not guarantee consumers' participation in PTR programs anymore. Consequently, we then investigate to which extent a high enrollment to IC PTR programs can be reached. We focus on two important features of the market environment: (1) whether electricity retail is handled by local monopolies or by (imperfectly) competitive retailers ; and (2) whether policy-makers decide to maintain the cross-subsidies embedded in the historical tariff.

Methods

Theoretical paper: microeconomics, industrial organization, and (tools from) mechanism design.

Results

The first part points out a structural flaw of PTR contracts: embedded arbitrage opportunities. Consumers are allowed to buy their baseline power (which they later resell) at a constant (state-independent) price while this power is worth more by construction. Under asymmetric information, strategic consumers are thus incentivized to inflate their baseline. We show that if one were to make a PTR design IC, it would become equivalent to a variable Critical-Peak-Pricing (vCPP) design, in which customers have to *purchase* their peak consumption at the spot price.

Under significant asymmetric information, the relevant economic issue is thus to design vCPP contracts optimally in order to achieve high enrollment rates under voluntary opt-in. If cross-subsidies to non-switchers are not-maintained and retail is perfectly competitive (or handled by a benevolent local monopoly), competitive screening (or a benevolent social planner) prevents any cross-subsidies to be sustainable: full-enrollment to Real-Time Pricing (RTP) ends up being the equilibrium outcome. If however the historical rate is frozen so as to protect non-switching consumers from an increase in their bills (i.e. if historical cross-subsidies are maintained), a second-best trade-off must be found between between the benefits of increased allocative efficiency, and the costs of maintaining cross-subsidies (i.e. either the costs of public funds or the opportunity cost of a local monopoly budget balance constraint). A perfectly competitive retail industry fails to reach this second-best outcome.

Conclusions

This paper tries to make it clearer why vCPP and PTR contracts are not equivalent, contrary to what is often thought within the industry. From a public policy perspective, it casts some doubts on the relevance of encouraging PTR market designs in liberalized electricity markets instead of indirect ways to create a price-responsive demand, for example by encouraging competitive screening.

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