A SYSTEM OF HOURLY DEMAND IN THE ITALIAN ELECTRICITY MARKET

NON TECHNICAL EXECUTIVE SUMMARY

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In this paper we analyze the demand in the Italian organized electricity market in 2010-2011, where there are many heterogeneous agents submitting bids. They are large industrial firms who buy directly in the market for their productive needs; traders and distributors who buy electricity in each hour and resell it to small industrial and tertiary firms and households. We want to study their behavior and investigate whether they behave rationally, which means that they are cost minimizers. According to the general demand theory, we assume a theoretical model where agents react to price signals expressing some well-defined willingness to pay for each hourly quantity.

Our novel approach considers a complete and simultaneous demand equation system. This means that each agent demands simultaneously 24 hours electricity quantities, one for each hour of the day. Thus, in our model the elementary "consumption good" is the quantity of the electricity in one hour. This is a plausible framework because the price of electricity is different in every hour. Electricity can be used for different fixed needs, which can be satisfied in different hours of the day, according to price convenience. The agent can substitute electricity consumption in one hour for another hour if it is convenient to do so (for instance the agent can use competing energy sources). This represents the characteristic of substitutability. Alternatively the agent may need to use electricity consecutively hour after hour, because for instance a complex production process so requires (for instance the agent can use electricity for drying after washing). This represents the characteristic of complementarity. In addition, agents can increase the demand for electricity more or less than proportionally than their expenditure budget. This allows to ascertaining whether hourly electricity demands can be considered normal or luxury goods, according to economic theory. For empirical estimation we consider an aggregate demand system which is the sum of the all individual agents' behavior.

In this paper, we use data of the Italian day-ahead market (IPEX). We note that in 84% of the hours, around the IPEX equilibrium price, the aggregate demand curve is somehow elastic. This shows that around the equilibrium price the aggregate demand behavior in the Italian market is price responsive.

Our econometric estimation shows new results in the literature. We compute significant estimates of expenditure and price elasticities, both own and cross elasticities. We find that electricity is moderately a luxury good in the day hours but it is a normal good in the night hours. Consumer reaction to prices shows negative own price elasticities around -0.05 to -0.12 range for night hours and in the -0.09 to -0.12 range for day hours. Thus

electricity demand is inelastic (a little more elastic when prices are higher, i.e. in day hours). We find that day hours are substitutes for night hours, but there is some complementarity among early morning hours and night hours.

In conclusion, our results offer some quantitative guidance for policy-makers to reform pricing regulation in Italy in a welfare improving direction. It is evident that appropriate regulation could favor consumers, if it can induce some behavior adjustment toward shaving consumption away from peak prices. Given the elasticity structure, this would yield lower aggregate equilibrium expenditures, because consumers can shift more easily their consumption from peak price (i.e. daily) hours to off peak (i.e. nightly) price. In addition we suggest to reform the actual two-price tariff structure. In fact, this latter gives to the final users only two aggregate price signals during the day: daily and nightly aggregate prices. Alternatively, our empirical finding show that consumers are hourly price sensitive in IPEX. Therefore, the introduction of real time pricing options for Italian final users would allow to fully passing the benefit to final users of the more sophisticated cost minimization behavior of traders.