Transparency and Bidding Behavior in Electricity Wholesale Markets

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Overview

Proposed changes in the regulation (SPDEM and REMIT) of European wholesale electricity markets require, among other things, that the market participants provide detailed records of wholesale market transactions including orders to trade. These changes are in part justified by the common misunderstanding that more information is always better. Economists argue that such detailed information is not needed for the efficient functioning of a market (von der Fehr, 2013). Rather, detailed and timely information may make it easier to maintain collusive behavior among market participants (Albæk, Møllgaard and Overgaard, 1997).

The supply function equilibria introduced by Klemperer and Meyer (1989) is widely used to characterize the behavior of suppliers in day-ahead (spot) markets for electricity (Holmberg, Newberry and Ralph, 2013). Bolle (1992) argues that there is a wide scope for tacit collusion in a market with supply functions as strategies. Furthermore, the literature on trigger strategies in repeated games suggest that detailed and accurate information about players' past decisions greatly increases the domain therein tacit collusion is a sub-game perfect Nash equilibrium (Porter, 1983; Friedman, 1986).

The Italian wholesale market for electricity (GME) started publishing, with one week delay, detailed bid information in May 2009. Prior to that date such details where only available with great delay. This provides us with a natural experiment where we can investigate the impact of increased transparency in the electricity market on market outcomes and bidding behavior. The purpose of this paper is to use the change in transparency in the Italian market to assess the impact of detailed bid information on the market performance. We are especially interested in finding out if the change in transparency has led to increased wholesale prices through collusive behavior among the power producers, or other changes in the bidding behavior.

Methods

We use the theory of supply function equilibrium to derive the best reply bidding strategies for an electricity producer to use in the spot market. From the detailed bid data we are able to construct residual demand curves and best reply responses following the method outlined in Wolak (2003). The change in information disclosure rules provides the experimental setup for a detailed statistical comparison of best reply responses before and after the change.

Results

The electricity prices exhibited substantial volatility prior to 2009. This volatility is greatly

reduced in 2010 and onward. The average price is somewhat higher. The residual demand curves are less volatile and the corresponding best replies tend to be more stable as well. In a few cases does prices drop substantially and unmotivated, and with later prices at a higher and more stable level. This price behavior is consistent with a hypothesis of producers following a trigger strategies with periods with penalty following defection from the collusive bidding strategy.

Conclusions

There is an ongoing reform process in European electricity markets where rules and regulation are changing in order to provide more transparency. One of the changes is a requirement that detailed spot market bid and production data will be made available to all market participants in a very timely manner. More information is not necessarily valuable to all market participants, nor conducive for efficient market outcomes. There is both theoretical and empirical evidence that certain types of market information facilitates tacit collusive behavior among market participants. The electricity market in Italy started disclosing bid information in 2009. Analyzing market outcomes before and after the policy change shows a sharp decline in price volatility and a small increase in price levels. This pattern in market outcomes matches that of EEX although there is a price decline in EEX.

The bid curves have changed from before the policy change to after the change. There is less volume in bilateral contracts. At the same time there is an upward shift in the bid curve. This is consistent with a hypothesis of collusive behavior. However, it does not follow that the change in disclosure policy lead to (caused) increased collusive behavior. Other factors may explain the upward shift. Although the change in policy in question is in many ways a natural experiment, it is not obvious from the data that there has been an *increase* in collusive behavior following the policy change. On the other hand, as there is some evidence of collusive behavior, we can not say that providing more information to the market participants have lead to better market outcomes.

References

Albæk, S., P. Møllgaard, and P. B. Overgaard (1997): "Government-Assisted Oligopoly Coordination? A Concrete Case," *Journal of Industrial Economics*, **45**(4), 429–443.

Bolle, F. (1992): "Supply Function Equilibria and the Danger of Tacit Collusion," *Energy Economics*, **14**(2), 94–102.

Friedman, J. W. (1986): *Game Theory with Applications to Economics*. Oxford University Press.

Holmberg, P., D. M. Newbery, and D. Ralph (2013): "Supply Function Equilibria: Step Functions and Continuous Representations," *Journal of Economic Theory*, **148**, 1509–1551.

Klemperer, P. D., AND M. A. Meyer (1989): "Supply Function Equilibria in Oligopoly Under Uncertainty," *Econometrica*, **57**(6), 1243–1277.

Porter , R. H. (1983): "Optimal Cartel Trigger Price Strategies," *Journal of Economic Theory*, **29**, 313–338.

von der Fehr, N.-H. M. (2013): "Transparency in Electricity," *Economics of Energy and Environmental Policy*, **2**(2), 87–105.

Wolak , F. A. (2003): "Identification and Estimation of Cost Functions Using Observed Bid Data: An Application to Electricity Markets," in *Advances in Economics and Econometrics: Theory and Applications*, ed. by M. Dewatripont, L. P. Hansen, and S. J. Turnovsky, vol. II, pp. 133–169. Cambridge University Press.