C. A. Bollino and P. Polinori

MEASURING MARKET POWER IN WHOLESALE ELECTRICITY ITALIAN MARKET

Department of Economics, Finance and Statistics - University of Perugia (I)
Via Pascoli 20, 06123, Perugia, Tel +39-075-585.5421, Fax +39-075-585.5299 (5057),
e-mail: bollino@unipg.it, polpa@unipg.it

Overview

In the new deregulated competitive Italian electric power market many competitive entities with different goals have replaced the old centralized decision making of the monopolistic environment. In this new contest many interesting issues arise as the market complexity, the firm strategic behavior, the market power size, and so on. Similar to other countries (Newbery, 2005), the Italian market has been organized as a sequence of a dayahead market, an adjustment market and a despatching resource market (Ancillary services market). The first market yields a system marginal price for each zone in which the market is separated due to network congestion (excess of physical transmission capacity), based on supply and demand bids. In the adjustment market, generators and loads submit offers/bids to correct parts of schedules which cannot be implemented due to technical constraints. Ancillary service market is a single market for procuring congestion relieve resources and for creating adequate secondary and tertiary control reserve margin. In this market resources are valued on a pay-as-bid basis. Other features of the market are: (i) in the period April – December 2004 only suppliers participated into the market, while demand was (inelastically) represented by the TSO; (ii) in January 2005 active demand bids entered in to the market, with the TSO being able to integrate bids if total market demand is "too different" from day-ahead forecast used for security management; (iii) in January 2005 the Single Buyer was instructed to use contract for differences (cfd) extensively and buy into the market. As a result, market liquidity rose to above 60%, due to Single Buyer dimension. (iv) Energy Authority enacted a market surveillance mechanism aimed at discouraging producers quantity withholding strategies, essentially "threatening" a "pay-as-bid" rather than "system marginal price" energy payment to a supplier, who withholds quantity aimed at exercising market power. In 2006, this provision was repealed due to a Court decision. The aim of this paper is twofold.

The first one is to build a theoretical model of firm competitive behavior in the Italian electric market. The second aim is to construct the residual demand for each Italian Generation Company, in order to measure the unilateral market power for the Italian Generation Companies.

Methods

Following the Wolak (2003a, 2003b) approach the appropriate measure of the unilateral market power is the Lerner index based on the residual demand curve elasticity which is computed as arc elasticity. We use the following methodology, computing: 1) the residual demand value for each Company in each hourly zone facing others suppliers; 2) the residual demand curve arc-elasticity, 3)the Lerner index. We consider that firm's behaviour is characterized by a profit function such as (where D(q) is demand and C(q) is cost function):

(1) $\Pi = D(q)\, q - C(q)$

The first order condition yields:

$D'q + p - MC = 0$ (where MC is marginal cost) from which we obtain:

(2) $D'q / p = (p - MC)/p$

resulting into the Lerner index (Lerner, 1934) computation as:

(3) $L = -1/ \varepsilon_D$ (where ε_D is elasticity of demand with respect to price).

Equation (2) allows to compute L if MC is known or to recover MC if D' is estimated econometrically (see Wolak 2000). Alternatively, if we assume that firm chooses the best pricing strategy considering the residual demand DR, i.e. considering the bids submitted by all other competitors, we can write for each firm i (suppressing index i for clarity):

(4) $\Pi = DR(p)\ (p - MC) + F$ where F is fixed cost, DR is residual demand ($DR = Q_D - Q_C$) and where Q_D is total demand, Q_C is supply of all other competitors. Obviously, profit maximization with respect to p yields:

(5) $(p - MC) / P = - 1 / \varepsilon_{DR} = L$

Equation (5) allows to interpret the computed value of L (the Lerner index) as a measure of unilateral market power which is exercised by firm i in each state of nature (observed market realisation). This is clearly so in the Italian case, where there are not any restrictions on the ability of suppliers to submit bids.According to market rules, bids can be submitted (quantity and price) before market closure, revising bids freely for the entire daily span, as many times as the producers deems necessary in order to adjust its production schedule. In conclusion, we assume that first: firms allocate "suggested" quantity at the "suggested" strike price to accommodate not eligible customers demand and then firms maximise profit in equation (4), thus effectively including contracts for differences in the fixed cost component.

Results

We analyze market data according to price quartiles, hourly clusters, geographical zones. In Italian market there are 21 generators and 8 elementary geographical zones (Bollino – Polinori, 2005; 2006); in each hour a separate market zone can occur, depending on grid congestion, joining several areas. The former monopolist (Enel) sets the price in 30% of hourly zone followed by Endesa, with 17% and Edison with 15%. The results obtained for the year 2004 are compared to those obtained for the year 2005 with active demand. The former monopolist (ENEL) emerges as one of the players with sizeable market power in Italy, with an index value similar to levels reported in other markets and considered proof of existence of "substantial market power". In some specific regions, Sardinia and Sicily, other players, Endesa and Edison, respectively, exhibit non negligible market power. Endesa sets price in Sardinia 25% of the time and Edison sets price in Sicily 33% of the times. The results of Lerner index calculation show clearly that ENEL has a greater market power than all other competitors. In particular, in 65% of computable data points, the Lerner index value is close to infinity (i.e. residual demand elasticity is close to zero). The average value, 0.383, is quite high and similar to the level reported in other markets (Borenstein et al. 2002 and Wolak, 2003a for California market; Sweeting, 2003, for England and Wales Pool market) and considered proof of existence of "substantial market power".

Conclusions

In this paper we addressed the issue of analyzing firm strategic behavior and market power in the new Italian deregulated electricity market using data on market bids made available by the Energy Authority which allowed us to compute Lerner index for each generator in

each areas and in each hourly clusters. The new data set cover the period 2004 – 2005, the first two years of the new electric Italian market.

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