ESTIMATING COST FUNCTION USING OBSERVED BID DATA IN WHOLESALE ELECTRICITY ITALIAN MARKET

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Overview

This paper examines the market for wholesale supplies of electricity in Italy to determine if the generators are able to exercise market power. For a specific bid function and marginal cost function there is a portfolio of forward financial contracts that can rationalize that bid function as expected profit maximizing. Generation unit owner's contract position affects the unit bid behavior in the spot electricity market (Wolak 2000, 2001). Following Wolak (2000, 2001 and 2003) we use the best response price concept in order to derive estimates of the cost function for a bidder in a competitive electricity market using actual bid information, the bid hedge contact position and the actual market outcomes.

Methods

We assume that the firm is able to observe the market demand and the bids submitted by all other participants. Consequently it firstly constructs the realized value of its residual demand function given market demand and bids and then selects optimal price associated with residual demand, firm's hedge contract position and marginal cost. Let C (q) the total variable cost associated with output q we write the profit function as:

$$\pi(q) = DR(p,\varepsilon)\times p - C\left(DR(p,\varepsilon)\right) - (p - PC)\times QC \tag{1}$$

From (1) we obtain the f.o.c (respect to p)

$$\pi'(q) = DR'(p,\varepsilon)\times\left(p' - C'\left(DR(p,\varepsilon)\right)\right) + \left(DR(p,\varepsilon) - QC\right) = 0 \tag{2}$$

The first order condition can be used to compute an estimate of marginal cost at the observed market clearing price p* as:

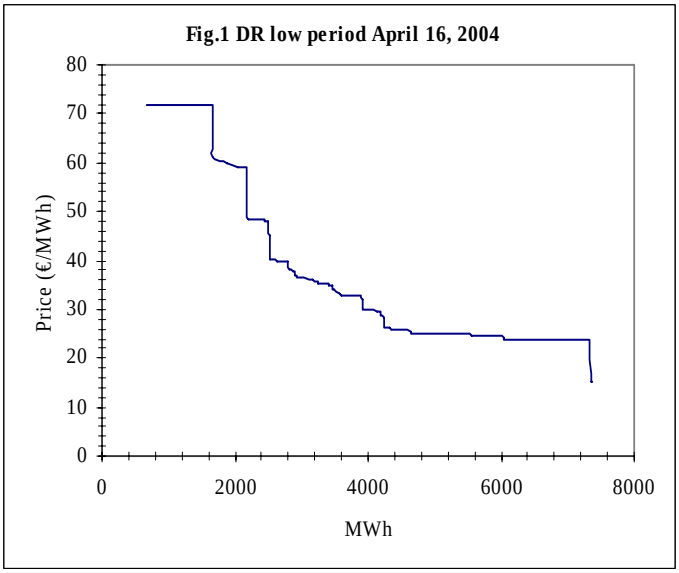
$$C'\left(DR'(p^*,\varepsilon)\right) = \frac{p^* - \left(QC - DR(p^*,\varepsilon)\right)}{DR'(p^*,\varepsilon)} \tag{3}$$

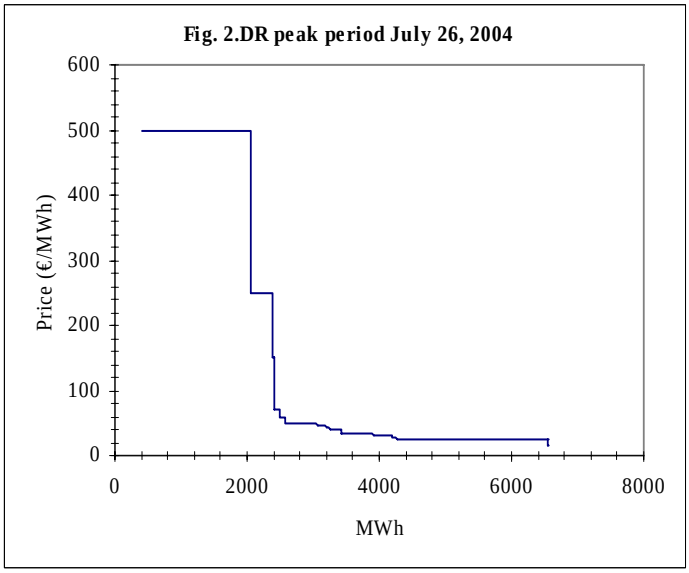
Where DR (p*, ε) can be directly computed and p* is directly observed, consequently residual demand computation is the only complication in order to obtain an estimate of marginal cost of firm at DR (p*, ε). Different techniques are available for this compution and they provide substantial invariant results (Wolak 2003, pp. 149-50), among these we approximate DR'(p*, ε) as:

$$DR'(p^*,\varepsilon) \approx \frac{DR(p^* + \delta,\varepsilon) - DR(p^*,\varepsilon)}{\delta} \tag{4}$$

Results

We present preliminary results of applying previous method. We used data on generator bids, market outcomes and quantity of the firm's forward contract obligations.Figures 1 and 2 show the actual DR faced by former monopolist in a rappresentative off-peak demand period and on-peak period. These curves have been smoothed using δ = 2.5 €. These curver confirm the idea that former monopolist possesses great opportunities to exercise market power during high market power demand.





Former monopolist faces a higher DR during peak period than in low demand load period but we have to use different δ value in order to chek the robustness of these results. Using hese information we estimate marginal cost function and test for its accuracy.

Conclusions

We use the marginal cost function and market outcomes in order to assess the magnitude of profit function and to compare different generation units in order to determine if substantial diffeeces exist. Preliminary results show that in wholesale electricity italian market Enel unit earn higher returns than units of others generators.

References

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