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DEREGULATION VS. PERFECT COMPETITION: MARKET POWER ON THE ELECTRICITY MARKET

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Overview

Market power has become a major concern in the operation of electricity markets. Although the introduction of deregulated markets was believed to bring cheaper electricity for the consumer, the prices rather seem to rise instead. A recent example is the request for higher retail prices raised by the power utilities in germany.

Of course, the power utilities argue that the production of electricity has become much more expensive due to higher fuel cost or higher expenses due to integration of renewable sources. On the other hand, the power companies are not able to dispel concerns that they rise the prices just because they have the power to do so.

The idea of the deregulation process was that removal of barriers and legal restrictions on the electricity market will bring a situation of perfect competition. Under perfect competition there is no company on the market that can influence the market price. All companies are price takers and the optimal trading strategy is given by their marginal cost.

But it has turned out that this is not the case in real markets. This paper therefore proposes a market model that takes strategic action of the participants into account. The model is required to be easy to compare with real markets, to be independent of restricting assumptions and to give a clear insight under which conditions market power can lead to unacceptable high prices.

Method

The paper shows that the market can be described without traditional assumptions by modeling the possible price influence of the companies with a linear approximation: the price change of the market is proportional to the generation capacity withheld from the market. On the basis of this model we further calculate the optimal trading strategy under uncertainty of the market price in a deregulated environment by maximizing the expected profit of a company for one auction of the electricity market.

The resulting trading strategy is independent of the market price probability distribution and is further free of oligopolistic assumptions: it holds for monopoly and oligopoly as well as for perfect competition. This optimal strategy makes the generation companies bid far above marginal cost with the optimal bidding function

$$b(q)=c(q)+kq.$$

$b(q)$ is the optimal bidding function, q is the quantity, $c(q)$ represents marginal cost and k quantifies the market price influence. k can be calculated from demand function and supply function slopes.

Results

Now that a model is formulated that incorporates strategic action of the suppliers, the consequences of market power can be estimated with respect to market performance. For example, the presented market model allows to show how market power does annihilate the benefits of cheap mass production.

We assume two different market supply situations, case *A* and *B*. In case *A* there are 5 suppliers, in case *B* 10 suppliers. The total production capacity is assumed equal for the two situations. In order to simulate the effect of the economies of scale, a single company of case *A* has for any volume half the marginal cost compared to a single company of case *B*. The marginal cost functions are considered linear. Furthermore, an arbitrary linear demand function is assumed. With these assumptions we calculate the market price for case *A* and case *B*. Fig. 1 shows that the situation with higher cost has a lower market price. Market power makes the case of 5 companies more expensive for the consumers.

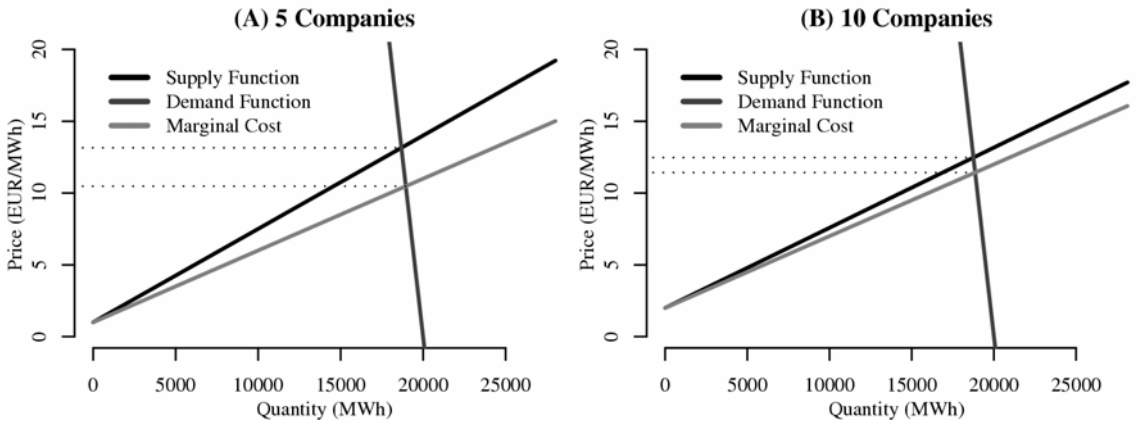

Figure 1: Comparison of market prices for the situations (A) 5 companies with equal marginal cost and (B) 10 companies each having twice the marginal cost than the companies in (A).

Conclusions

The paper derives an extremely simple market model that includes strategic action of the market participants. This model allows to explain the deviations of real markets from traditional economic considerations and combines the observations of recent research into one picture (e.g.: Haas (2004); Borenstein (2002); Joskow and Tirole (2004)). It shows that every company can exercise market power, the small companies as well as the big ones. On top of that, the supplying companies may even have the power to change legal restrictions.

In order to achieve a low market price in an economy of scale, the presented model allows to estimate a tradeoff between company scale and market power. As generalization for arbitrary energy markets we may further follow that a high market price does not necessarily indicate a production or resource shortage. It may well result from market power alone, which leaves us with the question if the insecurity of energy supply results in the near future from resource shortage or market power.

References

Severin Borenstein. The trouble with electricity markets: Understanding California's restructuring disaster. Journal of Economic Perspectives, 16(1): 191–211, 2002.

Reinhard Haas. The role of excess capacities for effective competition in electricity markets. In 6th IAEE European Conference, September 2004.

Paul L. Joskow and Jean Tirole. Reliability and competitive electricity markets. NBER Working Papers 10472, National Bureau of Economic Research, Inc, May 2004.

Walter Reinisch and Tetsuo Tezuka. Market power and trading strategies on the electricity market: a market design view. IEEE Transactions on Power Systems, submitted for publication.