

## ***COURNOT COMPETITION IN WHOLESALE ELECTRICITY MARKETS: THE NORDIC POWER EXCHANGE, NORD POOL***

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### **Overview**

The competitiveness of electricity markets has been a major topic in empirical industrial organization since the advent of the deregulation process in the 1990s. One reason is that electricity markets are often concentrated, which together with a highly inelastic demand creates opportunities to exploit market power. Another reason is the rich set of data available to researchers, creating opportunities to estimate less parameterized models than what is possible in other markets, where researchers typically have relied on variants of the conjectural variations approach developed by Bresnahan (1982).

A notable feature of these markets is that electricity is traded in multi-unit auctions, where retailers and producers submit supply and demand functions to a centralized power exchange. The residual demand function facing any particular firm can then be computed directly, rather than estimated. The slope of the residual demand function can then be used as a measure of that firm's ability to influence the wholesale price. Studies of market power in electricity markets are frequent, and notable studies using firm level bidding data include McRae and Wolak (2014) and Wolak (2003), both demonstrating that firms submit bids with higher prices when residual demand is less price elastic. Other examples include Wolfram (1999); Sweeting (2007); and Hortaçsu and Puller (2008), all finding evidence of market power as a contributing factor to market outcomes.

### **Methods**

We simplify the analysis of such auctions by noting that when the majority of supply bid variation stems from horizontal shifts, some firms compete in quantities rather than supply functions. Quantity competition reduces the informational requirements associated with evaluating market performance, because the markups of these producers then depend on the same residual inverse demand curve.

We develop a structural econometric model how to estimate markups in this environment, using only aggregate supply functions. We then apply the method to data from the Nordic Power exchange the day-ahead market of the Nordic power exchange, Nord Pool, for the years 2011-2013.

### **Results**

We estimate the mean markup among the quantity setting firms to be 8-11 percent.

### **Conclusions**

We develop a structural method how to estimate market power in electricity wholesale markets when only aggregate bidding data is available. Although the empirical analysis is limited to the Nordic market, other markets where only aggregate bidding data is available include e.g. France, Germany, Austria, and Switzerland. Future research could apply our method to data from these markets.

## References

Bresnahan, Timothy F., "The oligopoly solution concept is identified," *Economics Letters*, 1982, 10 (1-2), 87–92.

Hortacsu, Ali and Steven L. Puller, "Understanding strategic bidding in multi-unit auctions: a case study of the Texas electricity spot market," *RAND Journal of Economics*, 2008, 39 (1), 86–114.

McRae, Shaun D. and Frank A. Wolak, "How do firms exercise unilateral market power? Empirical evidence from a bid-based wholesale electricity market," in Eric Brousseau and Jean-Michel Glachant, eds., *The Manufacturing of Markets*, Cambridge University Press, 2014, pp. 390–420. Cambridge Books Online

Sweeting, Andrew, "Market Power In The England And Wales Wholesale Electricity Market 1995-2000," *Economic Journal*, 2007, 117 (520), 654–685.

Wolak, Frank A., "Measuring Unilateral Market Power in Wholesale Electricity Markets: The California Market, 1998–2000," *American Economic Review*, 2003, 93 (2), 425–430.

Wolfram, Catherine D., "Measuring Duopoly Power in the British Electricity Spot Market," *American Economic Review*, 1999, 89 (4), 805–826.