

Pricing Patterns in Wholesale Electricity Markets: Unilateral Market Power or Coordinated Behavior?

BY DAVID P. BROWN AND ANDREW ECKERT

Overview

Suspicious of coordinated behaviour may arise when firms are observed to be behaving in conspicuous ways that could be designed to communicate with rivals. Indeed, screens that have been employed by or recommended to antitrust agencies to identify possible coordination have looked at price uniformity and rigidity as well pricing anomalies observed in settings where coordination is suspected (Abrantes-Metz and Bajari, 2009). However, the observation of such unique patterns in prices does not necessarily indicate that the patterns are being used to coordinate at supra-noncooperative outcomes.

A recent example highlighting these concerns involves the wholesale electricity market in Alberta. Until recently, the complete list of firms' wholesale market bids was made public approximately ten minutes after the market cleared, but with generator and firm identifiers removed, through the Historical Trading Report (HTR). In 2013, Alberta's Market Surveillance Administrator (MSA), issued a report alleging that certain large firms were using the HTR to elevate market prices on certain days (MSA, 2013). Part of the MSA's concern was the allegation that firms were "tagging" offers, or employing certain patterns in offer prices, in order to reveal their identities through the HTR and to send messages. These concerns led to a hearing of the Alberta Utilities Commission (AUC) in 2017, which ordered the system operator to cease publication of the HTR (AUC, 2017).

There is a growing debate over the role of market transparency in wholesale electricity markets. In a static oligopoly setting with non-cooperative firms, existing literature suggest that information enhances market competition (Holmberg and Wolak, 2018). Alternatively, in a setting where agents interact repeatedly, it has been argued that information can help facilitate coordination (von der Fehr, 2013). Concerns over coordination in electricity markets have been documented in theoretical models [e.g., Fabra (2003)]. However, there is limited empirical evidence of coordinated behaviour in electricity markets. Two exceptions are Macatangay (2002) in England and Wales and Fabra and Toro (2005) in Spain. However, these papers do not investigate the role of market transparency in firms' abilities to coordinate on high-priced outcomes.

We build on the existing literature to develop an empirical methodology to examine whether observed offer behaviour in Alberta was consistent with firms unilaterally maximizing expected wholesale (spot) market profits and if firm behaviour differed on days where the tagging patterns were observed in the

HTR. Our analysis has important policy implications in the face of recent legislation to increase information disclosure and market transparency in European electricity markets (von der Fehr, 2013).

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Methodology

Our primary objective is to empirically evaluate if firms' bidding behaviour is consistent with static (unilateral) expected profit-maximization or whether their conduct is better explained as some form of coordinated behaviour. First, it is important to account for the presence of uncertainty in demand and wind output when firms formulate their bidding decisions. Consequently, we establish an empirical model to forecast hourly demand and wind in order to compute the estimated level of net demand (demand minus wind output) and the distribution of its residuals to capture market uncertainty. Second, for each hour, we construct a firm's residual demand curve by taking the estimated net market demand level and subtracting a firm's rival's observed offers to establish a downward sloping residual demand function. To account for the presence of demand and wind output uncertainty, we undertake a Monte Carlo simulation that randomly draws 1,000 values from the estimated residual distribution of net market demand. This establishes a distribution of net market demand point estimates and consequently, residual demand functions that a firm could face in any given hour.

Third, facing the estimated distribution of residual demand functions, we estimate a firm's expected profit and the distribution of market-clearing prices from employing its observed offer strategy. Fourth, we construct an array of counterfactual offer curves to investigate if several large firms could have employed alternative offer strategies to elevate their expected profits, and whether the profitability of unilaterally deviating was greater on days where unique tagging patterns were observed.

Results

We focus on two firms that were the subject of concerns raised by the Alberta Market Surveillance Administrator. We illustrate that these firms alter their offer behaviour in on-peak hours when unique offer patterns were observed in the HTR. More specifically, these firms elevated the offer prices on their coal and natural gas generation units often establishing a high-priced shelf in the market-level offer curve. We do not observe similar systematic responses by other large

firms.

Our analysis finds that one of these firms could have unilaterally increased its expected profits through deviations that involve reducing offers on its high priced units. The potential gains in its expected profits are pronounced on days where it employed its unique offer pattern resulting in increases of up to 15% in its hourly expected profits. These expected profit gains exceed even conservative estimates of ramping and startup costs. This rules out the explanation that the firm was pricing out its generation units to avoid these dynamic costs.

For the other firm of focus, results are less clear; while deviating optimally could unilaterally increase its expected profits, such deviations are complicated and involve both increasing and decreasing offers depending on circumstances. Further, there is limited evidence that the profitability of deviating is greater on days in which pricing patterns are employed. Our results are consistent with a firm taking a leadership role to increase market prices in certain hours.

Conclusion

A difficulty in cases involving an allegation of coordinated behaviour is that suspicious conduct observed by firms suspected of coordination may have other explanations. As a result, it is important that in such cases an analysis be carried out to investigate whether observed conduct is consistent with unilateral profit maximization, or is better explained by a theory of coordinated behaviour. In this paper, we carry out such an exercise in the context of Alberta's wholesale electricity market, in which the industry's monitoring agency had accused certain firms of setting prices designed to convey information to rivals and to signal intentions regarding future behaviour.

Overall, our findings provide support for the concern that tagging patterns may be associated with bidding that deviates from non-cooperative equilibria. In particular, for one of the large firms of interest, we find that it could have elevated its expected profits by up to 15% in certain hours by pricing in its tagged generation units.

In the face of increased renewable generation resources, there is a recent movement to increase market information and transparency to better manage renewable resource intermittency and facilitate more accurate price forecasts for market participants [e.g., see EU (2013)]. However, our findings provide support for concerns that detailed near real-time information on firms' bids can be detrimental to market competition in concentrated wholesale electricity markets where firms interact repeatedly. In addition, attempts to de-identify data published in near real-time may not be sufficient to alleviate concerns over the use of market information to facilitate coordinated behaviour.

References

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IAEE Student Chapter Leaders Meeting

BY PABLO BENALCAZAR, IAEE STUDENT COUNCIL REPRESENTATIVE

On the 31st of March, the IAEE Student Chapter Leaders Meeting was held on the premises of the HEC Montréal. During this meeting, IAEE's Student Council Representative, Pablo Benalcazar provided an update to all delegates on the student activities sponsored by or involving the IAEE and encouraged student chapters to promote their activities online on social media by mentioning @IA4EE. IAEE Student Chapter Leaders discussed the development of a Student Chapter

Manual, intended to serve as a general guide for current and future student chapter officers on the administration of IAEE student chapters. The meeting also held discussions on additional services and new ideas to strengthen the collaboration among student chapters, keep current student members engaged, retain former student members and increase the visibility of the IAEE community.

