RISKS AND INCENTIVES FOR GAMING IN ELECTRICITY REDISPATCH MARKETS

Anna Pechan, Constructor University, apechan@constructor.university.de
Christine Brandstätt, Copenhagen Business School, cbr.eco@cbs.dk
Gert Brunekreeft, Constructor University, gbrunekreeft@constructor.university.de
Martin Palovich, Constructor University, mpalovich@constructor.university.de

Overview

Market design for electricity often initially ignores network congestion within one bidding zone and addresses it in a second, so-called 'redispatch' stage. For market participants, any two-stage design offers an opportunity to strategically optimize between the different market stages. In Europe the current debate is how to design a market-based redispatch to integrate new actors, in particular consumers, given increasing levels of congestion (ACER 2021, CEER 2021, ENTSO-E 2021, Palovic et al. 2022). Strategic bidding may occur if market players anticipate congestion in their region and manipulate bidding to exploit this congestion.

In this paper, we study the precise incentives for gaming with respect to competitive conditions in the market with a formal model. We propose that depending on competition, the expected profits of gaming can be negative and link the range of expected gaming loss to a so-called reference bidder, reflecting competitive conditions in the market. Thus, we provide the theoretical framework for authorities and empirical works to assess the potential of market-based as opposed to administrative redispatch. Based on this theoretical framework we also discuss how several potential remedies can increase the risk of the gaming strategy and can thereby reduce the practical potential for gaming.

Methods

We study the precise incentives for inc-dec gaming with respect to competitive conditions on the market with a formal model. To the best of our knowledge, the literature[1] lacks a formal representation of the effect of competition on the incentives of gaming in redispatch or flexibility markets. As a consequence, it has been controversial to what extent competition mitigates the incentives for gaming. To close this gap, we focus on the incentives of a single potential gamer and draw up a profit function including probabilities of selection which in both markets depend endogenously on the gamers own bid as well as exogenously on a normally distributed reference bid.[2] The gamer needs to outbid the reference bidder to be scheduled in the market.

Results

The range where expected profit of gaming is negative is critically determined by competitive conditions in the market in both and particularly the second market stage. The stronger the competition in the market, the less likely gaming will be. The role of the reference bidder is critical. The gamer has to outbid this reference bid; and if the reference bid is high, the profit margin for the gamer will be low. We distinguish three different types: 1. strong reference bidders, 2. weak reference bidders and 3. the special case of facilities that are exclusively required for congestion relief, which is basically equivalent to a situation without reference bidders. The presence of a strong reference bidder makes gaming unlikely and a weak reference bidder facilitates gaming.

Furthermore, we note that even where gaming is possible, remedies may mitigate the problem and that system operators could be authorized to execute these remedies. Exploiting the insights from the formal model, we discuss several remedies which affect the incentives for gaming, such as long-term contracting of a weak reference bidder, use of alternative flexibility options by the network operator and occasional random calls in the local market.

[1] Ito & Reguant (2016) and Borenstein et al. (2008) on strategic bidding in sequential electricity markets of equal geographical scope - Hogan (1997), Borenstein et al. (2000), adn Joskow and Tirole (2000) on market power abuse in locationally differentiated but not sequential markets - Dijk & Willems (2011), Holmberg & Lazarczyk (2015) and Hirth & Schlecht (2020) on incentives for strategic behaviour in redispatch, not focussing on the effect of competition – recent empirical and simulation-based assessments by Sarfati et al. (2019, 2020), Graf et al. (2020), and Perino & Schnaars (2021)

[2] We do not model a game-theoretical equilibrium between several strategic bidders.

Conclusions

Gaming in electricity markets with market-based redispatch involves risks. These depend on the expected profits of the strategy and the risk of unsuccessful gaming. With strong competition or in a well-designed market the potential for gaming can likely be contained. However, It requires careful empirical analysis of the real market situation to assess the potential threat. The assessment can differ regionally: in some regional market the incentives for gaming will be strong, whilst in others they are not. Therefore, adequate market design may differ regionally. With the presented analysis, we provide the theoretical framework for authorities and ex-post empirical works to assess the potential of market-based as opposed to administrative redispatch and also to design markets for local flexibilities.

References

Agency for the Cooperation of Energy Regulators (ACER) (2021). REMIT Quarterly Q1: ACER guidance on the application of REMIT and transaction reporting. https://documents.acer-remit.eu/wp-content/uploads/REMITQuarterly_Q1_2021_1.0.pdf

Borenstein, S. Bushnell, J., & Stoft, S. (2000). The Competitive Effects of Transmission Capacity in a Deregulated Electricity Industry. RAND Journal of Economics, 31 (2): 294-325.

Borenstein, S., Bushnell, J., Knittel, C.R., & Wolfram, C. (2008). Inefficiencies and Market Power in Financial Arbitrage: A Study of California's Electricity Markets. Journal of Industrial Economics, 56 (2): 347-78.

Council of European Energy Regulators (CEER) (2021). Redispatching Arrangements in Europe against the Background of the Clean Energy Package Requirements. Ref: C21-FP-52-03. https://www.ceer.eu/documents/104400/-/-/7421d0f3-310b-f075-5200-347fb09ed83a

Dijk, J. & Willems, B. (2011). The effect of counter-trading on competition in electricity markets. Energy Policy, 39, pp. 1764-1773.

European association for the cooperation of transmission system operators for electricity (ENTSO-E) & Frontier Economics (2021). Review of flexibility platforms. https://www.entsoe.eu/news/2021/11/10/entso-e-publishes-new-report-on-flexibility- platforms/

Graf, Ch., Quaglia, F. & Wolak, F. (2020). Simplified electricity market models with significant intermittent renewable capacity: Evidence from Italy. NBER Working Paper No. 27262. http://www.nber.org/papers/w27262. Accessed on 02. Dec. 2022.

Hirth, L. & Schlecht, I (2020). Market-based redispatch in zonal electricity markets: The preconditions for and consequence of Inc-dec gaming. Working Paper. ZBW – Leibnitz Information Centre for Economics.

Hogan, W. (1997). A Market Power Model with Strategic Interaction in Electricity Networks. The Energy Journal, 18(4), pp. 107-141.

Holmberg, P. & Lazarczyk, E. (2015). Comparison of congestion management techniques: Nodal, zonal and discriminatory pricing. The Energy Journal, 36(2), pp. 145-166.

Ito, K. & Raguant, M. (2016) Sequential Markets, Market Power, and Arbitrage. American Economic Review, 106 (7): 1921-57.

Joskow, P.L. & Tirole, J. (2000) Transmission Rights and Market Power on Electric Power Networks. RAND Journal of Economics, 31 (3): 450-487.

Palovic, M., Brandstätt, Ch., Brunekreeft, G. & Buchmann, M. (2022). Strategic behavior in market-based redispatch: International experience. The Electricity Journal, 35(3).

Perino, G. & Schnaars P (2021). Arbitrage in cost-based redispatch: Evidence from Germany. https://ssrn.com/abstract=3890723 or http://dx.doi.org/10.2139/ssrn.3890723

Sarfati, M. & Holmberg, P. (2020). Simulation and Evaluation of Zonal Electricity Market Designs. Electric Power Systems Research, 185. https://doi.org/10.1016/j.epsr.2020.106372.

Sarfati, M., Hesamzadeh, M. R. & Holmberg, P. (2019). Production efficiency of nodal and zonal pricing in imperfectly competitive electricity markets. Energy Strategy Reviews, 24, pp. 193-206. https://doi.org/10.1016/j.esr.2019.02.004.