

Market power in Norwegian electricity market: Are the transmission bottlenecks truly exogenous?

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Executive Summary

Since the liberalization of electricity markets around the world, several studies have looked into the impact of transmission congestion on producers' exercise of market power. Among these studies, particular focus has been placed on the impact of physical or financial transmission rights on the exercise of market power. Studies of the Norwegian electricity market that look into the impact of transmission congestion on market power find limited evidence that producers exploit transmission bottlenecks and exercise market power. Many of the studies attribute the success of the NordPool electricity market in terms of limited market power to a sound market design that reduces the incentives for the exercise of market power and the of dilution of major domestic producers in the large NordPool market.

The results from these studies can, however, be interpreted as the average markup of producers over time where the underlying models consider the event of binding capacity constraints as exogenous. This implies that the producers utilize a passive strategy with fixed markups over a period but invariant over time. Specifically, the issue that both the international and Norwegian studies fail to address empirically is the issue of "induced transmission congestion". "Induced transmission congestion" implies that by recognizing the limited import transmission capacity, the dominant firms in an importing zone might strategically reduce their output in order to induce congestion in their region, thereby providing them an opportunity for exercising market power with respect to any residual demand left unserved in the importing region.

In this scenario, transmission congestion in the system might not always be exogenous, rather the result of producers' strategy to exercise market power by endogenizing the transmission constraints. In this background, our study assesses the extent of market power in Norwegian electricity market and provides answers to the following questions using hourly data from 31st May 2004 to 20th April 2008 for southern Norway price zone:

1. Are the import transmission bottlenecks exogenous in the Norwegian electricity market?
2. What is the extent of markups over the marginal cost under the events when producers act strategically and induce transmission congestion in the importing zone?

We have employed Green and Porter (1984) to study the non-competitive behavior of electricity producers in the Norwegian electricity market. They argue that non-competitive behavior in a particular industry structure can be assessed from the pattern of industry performance across different time periods. The distinctive behavior of firms under different regimes provides an opportunity for drawing inference about the presence or absence of non-competitive behavior using aggregated industry level data. According to Green and Porter (1984), looking for non-competitive behavior of the industry in situations when non-competitive behavior might plausibly occur, provides an important opportunity to find whether the firms exercised market power or not.

Two stage GMM results of the supply equation suggest that markup parameter is significant at 5 percent during the late night and morning hours when southern Norway is generally a net importer of electricity and cheap electricity is imported from the connected price zones either until the prices equalize or the transmission capacity is fully exhausted. The relatively small size of the market during these hours provides an opportunity for strategic producers to reduce their output and thus induce transmission congestion in their price zone and earn markups above the marginal cost. These results are further supported by the average trend in which import and export capacities are determined between southern Norway and the connected price zones across different hours of the week. From midnight to 7.00 AM when southern Norway imports electricity most of the times, import capacity set by *Statnett* during these hours is always at its minimum compared to the rest of the hours in a day and the transmission lines have remained congested for about 25 percent of the times during these hours. During these hours when producers expect that with their strategic actions they can induce transmission congestion and the outcomes fall in line with their formed expectations, the coefficients on markup parameter are highly significant statistically and the extent of markups is higher. Prices during these hours have remained about 19.5 percent higher than the competitive levels.

The endogeneity results of the binary variable for import congestion are in line with the statistical significance of the estimated markups and the trend in transmission capacities being determined in the Norwegian electricity market. Import transmission congestion is endogenous at the 5 percent level during the late night and morning hours, while it is exogenous during the rest of the hours of the day. These are mostly the hours when import capacity is at its minimum in the southern Norway price zone. These endogeneity results and the statistical significance of our markup parameter during these hours confirm our conjecture that strategic producers change their bidding behavior to induce transmission congestion into their zone to drive prices away from the competitive levels.

The results imply that producers are well able to anticipate and use the available transmission capacity information extended by the Norwegian transmission system operator (Statnett) in their favor to induce transmission congestion into their price zone. It also suggests that NordPool's policy of sharing the available transmission capacity information to ensure market transparency is not welfare maximizing as it helps producers to drive price away from competitive equilibrium whenever possible.