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From Hidden to Explicit Congestion: The Welfare Effects of Bidding Zone Subdivision in the Norwegian Electricity Market

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In zonal electricity markets, generators and consumers within the same bidding zone face the same price, as if the grid inside the zone were never congested. When power lines in a zone are congested, electricity cannot flow from where it is abundant to where it is scarce, but a single price does not reveal this scarcity, while splitting the zone lets prices differ across its parts and so reveals it. Regulators and system operators across Europe are considering the optimal number of zones and where to draw them, relying mostly on evidence based on simulation models, while few studies look at reforms that were actually implemented. This paper studies one of them: in April 2009, Norway divided an area covering central and northern Norway into two separate zones, one area structurally short of electricity and a more generation-rich one, at a time of low reservoir levels and reduced import capacity. Using hourly prices in the 100 days before and after the reform, a difference-in-differences analysis compares the two new zones with a neighbouring zone, separates the part of the price change that can be attributed to the split from changes that affected the whole area, and then measures the resulting efficiency gain from the prices actually observed.

Finer granularity of zones cannot reduce efficiency in a stylised benchmark, so the subsequent questions are how large the gain is and who gains and who loses. The two new zones had the same price in most hours, so the split made little difference most of the time. Its effect was concentrated in rare hours of severe local scarcity, such as 22 July 2009, when prices in the two zones diverged sharply and in the opposite direction to the usual pattern, something a single price would have hidden. The efficiency gain from separate prices is positive but small: about 0.01% of the price of each MWh consumed in the two new zones. However, the main finding is distributional: a price rising in one zone and falling in the other mainly moves surplus between consumers and producers, and these transfers are about twelve times larger than the gain. They change direction between normal days and rare episodes, so that over the year the net transfers are smaller than the amounts moving in each direction.

The results offer evidence from a real reform for markets considering additional zones or introducing zonal pricing, providing a way to measure the related effects from observed prices. They suggest that, in an integrated system, separate prices are not needed most of the time, but

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may matter during episodes of local scarcity, and that the distribution of costs and benefits between consumers and producers may weigh more in the decision than the efficiency gain itself. The results are indicative, as they cover a short period around the reform and are sensitive to the length of the period considered; the annual estimate of the gain rests on a single observed episode, and the analysis does not consider longer-term effects on investment or the costs of fragmenting the market. Extending the analysis to other zonal reforms would show whether these findings are representative.

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