Market-based Redispatch may result in Inefficient Dispatch

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Today, in most industrialized countries, electricity markets have been liberalized, with only transmission services being subject to regulation. Thus, free market interaction governs supply and demand while regulated transmission system operators (TSOs) operate the network. As the dispatch resulting at the day-ahead electricity wholesale spot market often does not entirely reflect the relevant network constraints, the TSO is typically engaged in congestion management, which follows day-ahead spot market trading. In the case of spot market allocations that are infeasible for the given network, the TSO intervenes ex-post and adjusts the traded quantities to restore network feasibility. These short-run operations are commonly called redispatch operations.

To determine allocations and reimbursements of firms in the redispatch procedure, two types of redispatch systems are mainly implemented and discussed in the literature. Under a cost-based redispatch system (CBR) – as it is applied in Austria, Switzerland, or Germany – variable cost of production is the basis for redispatch payments. As a CBR compensation is purely based on the incurred short-run cost of redispatched producers, it clearly aims at minimizing congestion management cost of the TSO. In contrast, under market-based redispatch or counter-trading (MBR) the TSO procures redispatch quantities at the different nodes in a market environment. Depending on the specific pricing rules applied (marginal pricing or pay-as-bid pricing), the compensation of market participants can be different from short-run cost. Versions of counter trading are used in the Nordic market (comprising Denmark, Finland, Norway, and Sweden), in the Netherlands, and in the United Kingdom.

The different redispatch systems induce different levels of redispatch cost for the TSO. The present analysis focuses on potentially changed incentives of the TSO to choose redispatch adjustment quantities under the different redispatch systems. TSOs in electricity markets are typically regulated based on an incentive regulation, which establishes limits for the prices that can be charged to customers for transmission services. A reduction of cost incurred by the TSO allows for larger profits, providing incentives for an efficient cost reduction. In many cases, TSOs thus have incentives to minimize their spendings, including those resulting in the redispatch process, which is the case, e.g., in the UK or Germany. As our analysis indeed shows, an incentive regulation inducing the minimization of redispatch cost as the objective of the TSO can be highly problematic in case of MBR since it may result in distorted redispatch choices. In contrast, in case of CBR incentives of the TSO to minimize redispatch cost yield undistorted redispatch decisions and, therefore, maximize welfare.

To analyze those important issues in more detail, the paper at hand introduces a model that allows to assess the short-run impact of the different redispatch regimes on the redispatch decisions taken by the TSO in a liberalized electricity market. We consider a spot market with a uniform market price for the case of elastic spot market demand and multiple generation technologies at the

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different network nodes. Subsequent redispatch is applied to deal with network congestion. Assuming that the TSO is incentivized to minimize redispatch cost, we explicitly compare CBR to two different variants of MBR. The model is applied to a simple two-node network as it is often used in the literature as well as to a setting with three nodes and more complex physical network constraints.

For the case of only two-node networks, we show that both CBR and MBR result in identical welfare-maximizing outcomes, which is in line with existing literature. As a main result, for networks with at least three nodes we demonstrate that in contrast to a CBR mechanism, redispatch cost minimization of the TSO may not always imply welfare maximization in the case of MBR. We show that the TSO might have incentives to decrease MBR redispatch cost at the expense of market efficiency. Based on this finding, we finally emphasize the importance to establish a regulation where the TSO is obliged to implement the welfare maximizing (instead of the redispatch cost minimizing) dispatch for electricity markets that use MBR. This would result in the same efficient outcomes as under a CBR regime. Observe that our results do not require the assumption of strategic firms, but already hold for the standard case of perfect competition.