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Supply function equilibria in transportation networks

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The transport of electricty is limited by transmission constraints. They limit trade, which makes production and consumption less efficient. Moreover, transport constraints reduce competition between agents situated in separated markets, which worsens market efficiency even further. Congestion is of particular importance for markets with negligible storage possibilities, such as wholesale electricity markets. Then demand and supply must be instantly balanced and temporary congestion in the network can result in large local price spikes. The same market can at times exhibit very little market power and, at other times, suffer from the exercise of a great deal of market power. Borenstein et al. (1999) show that standard concentration measures such as the Herfindahl-Hirschman index (HHI) work poorly to assess the degree of competition in such markets. Thus competition authorities who need to predict the use of market power under various counterfactuals -- what might happen if a merger or acquisition is accepted or transport capacity is expanded, need more detailed analytical tools.

By means of a game-theoretical model we analyze the influence that a network's topology and transmission constraints have on competition in electricity markets. We are the first that are able to solve for strategic equilibria in such a model when producers compete with supply functions. Our expressions are limited to networks that are symmetric from producers' point of view. But it should be possible to use our conditions to numerically solve for supply function equilibria in asymmetric networks with asymmetric firms.

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