Market Power in Theory and Practice

Comments on
Paul Joskow and Jean Tirole:
"Transmission Rights and Market Power on Electric Networks"
(January 27, 2000)

Tor Arnt Johnsen, Shashi Kant Verma and Catherine Wolfram:
"Zonal Pricing and Demand-Side Bidding in the Norwegian Electricity Market"
(October 2, 1999)

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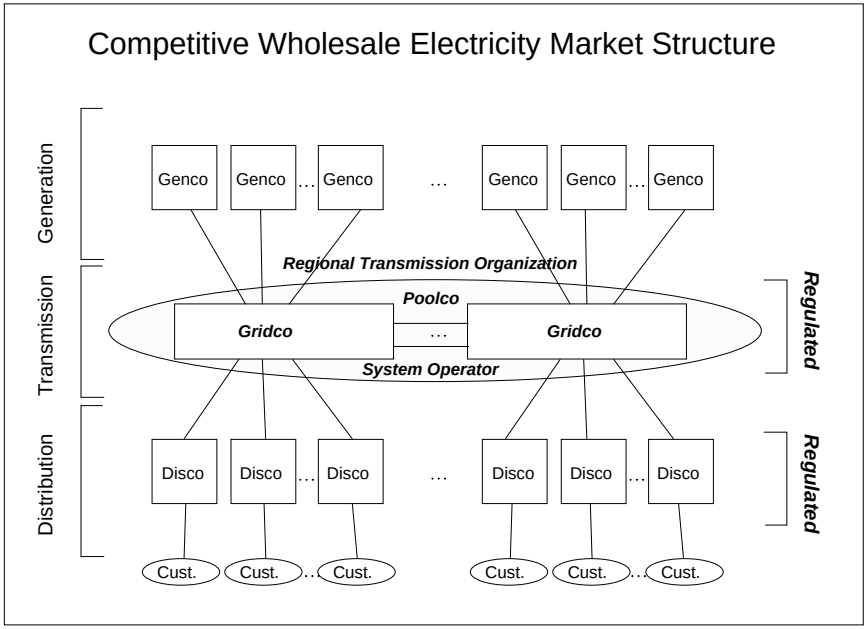
Context: What is this policy debate about? It is about the design of market institutions and the interaction with market power.

Contribution: What do these papers contribute to the discussion? Transmission rights have a natural place in the competitive case but can have perverse effects in the presence of market power. The interactions with other market institutions depend on the microstructure of market design. The distinction between financial rights and physical rights may be less than meets the eye. The empirical experience with a reasonably well designed market reveals signs of the exercise market power.

Caveats: What might we worry about next? The results suggest the complexity of the interaction with the microstructure in real networks. On balance, the papers would support a sense of caution about creating cures through market design that are worse than the disease of market power.

The usual separation into generation, transmission, and distribution is insufficient. In an electricity market, the transmission wires and the pool dispatch are distinct essential facilities.



The special conditions in the electricity system stand as barriers to an efficient, large-scale bilateral market in electricity. A pool-based market model for regional coordination helps overcome these barriers.

TRANSMISSION CAPACITY — Definition

Electricity restructuring requires open access to the transmission essential facility. A fully decentralized competitive market would benefit from tradable property rights in the transmission grid. However, the industry has never been able to define workable transmission property rights:

> "A primary purpose of the RIN is for users to learn what Available Transmission Capacity (ATC) may be available for their use. Because of effects of ongoing and changing transactions, changes in system conditions, loop flows, unforeseen outages, etc., ATC is not capable of precise determination or definition. "
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> Comments of the Members of the PJM Interconnection, Request for Comments Regarding Real-Time Information Networks, Docket No. RM95-9-000, FERC, July 5, 1995, p. 8.

The difficulty is fundamental.

- **Contract-Path Fiction:** Electric power does not follow a simple "contract path" through the network. Power flows throughout the network, creating complex interactions that give rise to significant "network externalities" and the failure of property rights.

- **Physical versus Financial Approaches:** Physical property rights, to match with physical flows, have proven to be elusive. There is an alternative through a mixture of physical flows and financial contracts that can internalize the externalities and create the equivalent of property rights in the transmission system.

A workable definition of "Available Transmission Capacity" would be radically different from the notional physical right that is the implicit foundation of the present regulatory approach.

The role of loop flow and its effects in the system needed to support a competitive market are important matters. The problems are fundamental in the presence of customer choice and competition. The principal implications of the ubiquitous and important effects of loop flow include:

No Property Rights. There is no workable system of property rights governing use of the transmission grid that would support a fully decentralized electricity market.

No Definition of "Available Transmission Capacity." It is not possible to define available transmission capacity (ATC) for a transmission interface without knowing everything about the use of the network at the time.

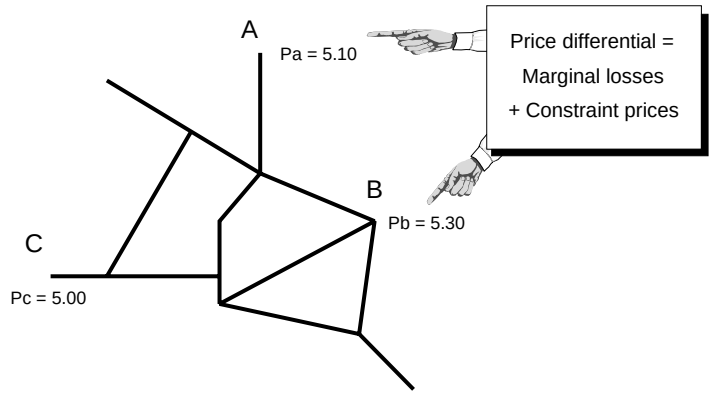
No Separation of Transmission Pricing and Spot Market. The opportunity cost of transmission depends critically on the marginal costs of power at different locations, and these costs are determined simultaneously with the dispatch and the spot market.

No Escape from the Network Externalities. There is a fundamental externality in transmission use, and decentralized markets do not deal well with externalities.

The natural extension of a single price electricity market is to operate a market with locational spot prices.

- It is a straightforward matter to compute "Schweppe" spot prices based on marginal costs at each location.
- Transmission spot prices arise as the difference in the locational prices.

LOCATIONAL SPOT PRICE OF "TRANSMISSION"



Price of "Transmission" from A to B = Pb - Pa = 0.20
Price of "Transmission" from A to C = Pc - Pa = -0.10

The independent system operator provides a dispatch function. Three questions remain. Just say yes, and the market can decide on the split between bilateral and coordinated exchange.

- **Should the system operator be allowed to offer an economic dispatch service for some plants?**

The alternative would be to define a set of administrative procedures and rules for system balancing that purposely ignore the information about the costs of running particular plants. It seems more natural that the operator consider customer bids and provide economic dispatch for some plants.

- **Should the system operator apply marginal cost prices for power provided through the dispatch?**

Under an economic dispatch for the flexible plants and loads, it is a straightforward matter to determine the locational marginal costs of additional power. These marginal costs are also the prices that would apply in the case of a perfect competitive market at equilibrium. In addition, these locational marginal cost prices provide the consistent foundation for the design of a comparable transmission tariff.

- **Should generators and customers be allowed to participate in the economic dispatch offered by the system operator?**

The natural extension of open access and the principles of choice would suggest that participation should be voluntary. Market participants can evaluate their own economic situation and make their own choice about participating in the operator's economic dispatch or finding similar services elsewhere.

The RTO Final Rule addresses the three critical questions. The RTO answer is "Just Say Yes."

Should the system operator be allowed to offer an economic dispatch service for some plants?

Yes. "Real-time balancing is usually achieved through the direct control of select generators (and, in some cases, loads) who increase or decrease their output (or consumption in the case of loads) in response to instructions from the system operator." (p. 635.) "...proposals should ensure that (1) the generators that are dispatched in the presence of transmission constraints must be those that can serve system loads at least cost, and (2) limited transmission capacity should be used by market participants that value that use most highly." (pp. 332-333.)

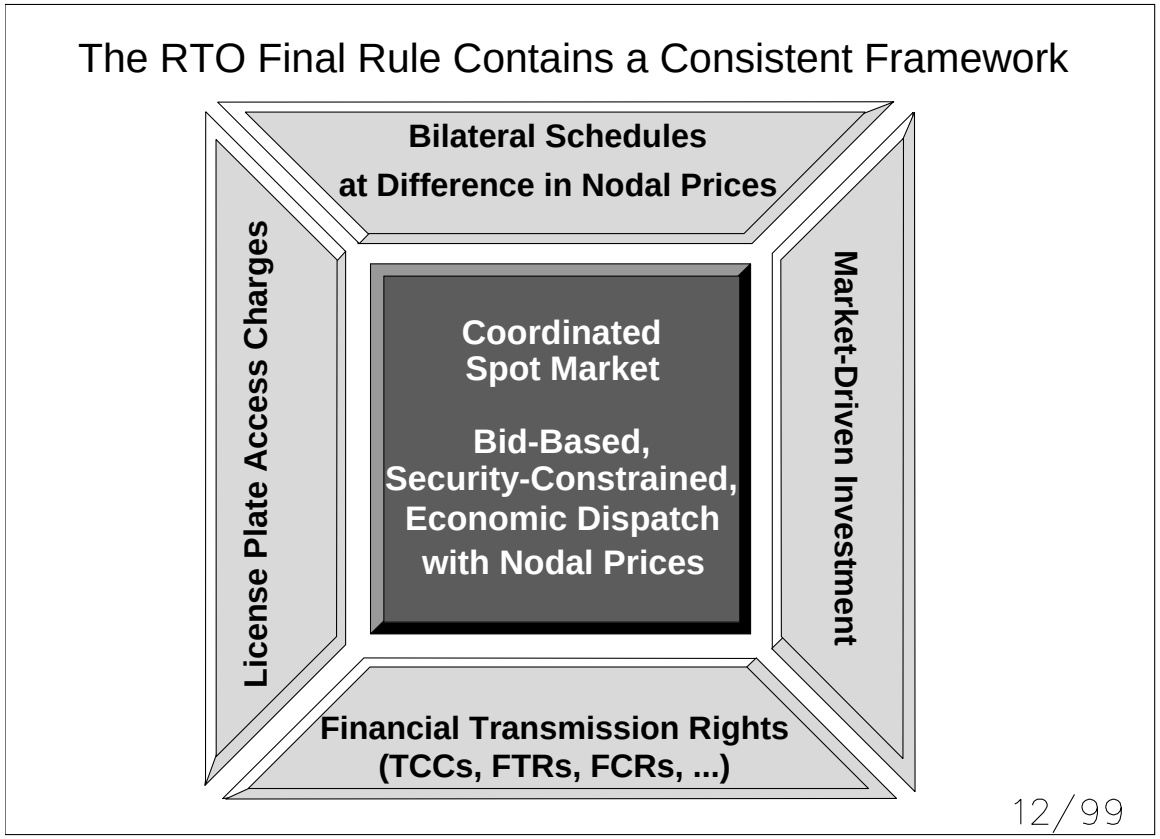
Should the system operator apply marginal cost prices for power provided through the dispatch?

Yes. "...we will require the RTO to implement a market mechanism that provides all transmission customers with efficient price signals regarding the consequences of their transmission use decisions." (p. 382.)

Should generators and customers be allowed to participate in the economic dispatch offered by the system operator?

Yes "The Regional Transmission Organization must ensure that its transmission customers have access to a real-time balancing market. The Regional Transmission Organization must either develop and operate this market itself or ensure that this task is performed by another entity that is not affiliated with any market participant" (p. 715.)

The RTO-Rule and earlier Capacity Reservation Tariff [CRT] contain a workable market framework that is working in places like the Pennsylvania-New Jersey-Maryland Interconnection (PJM).

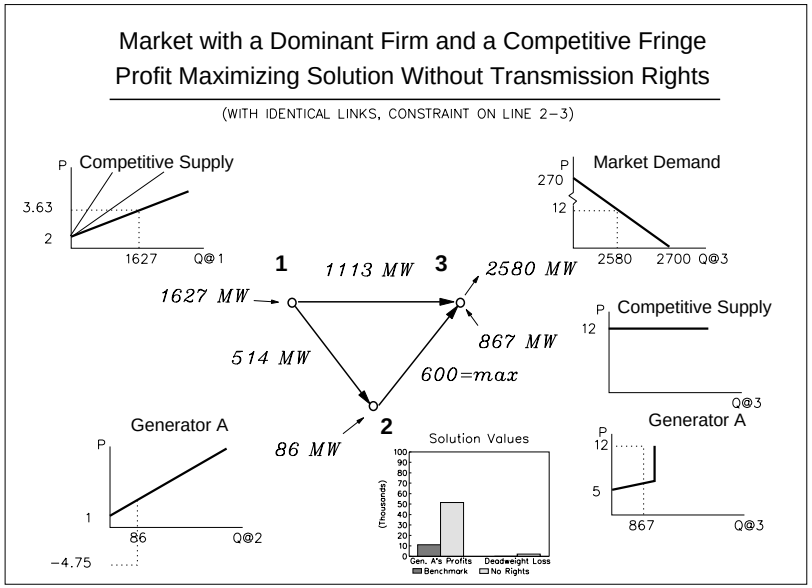


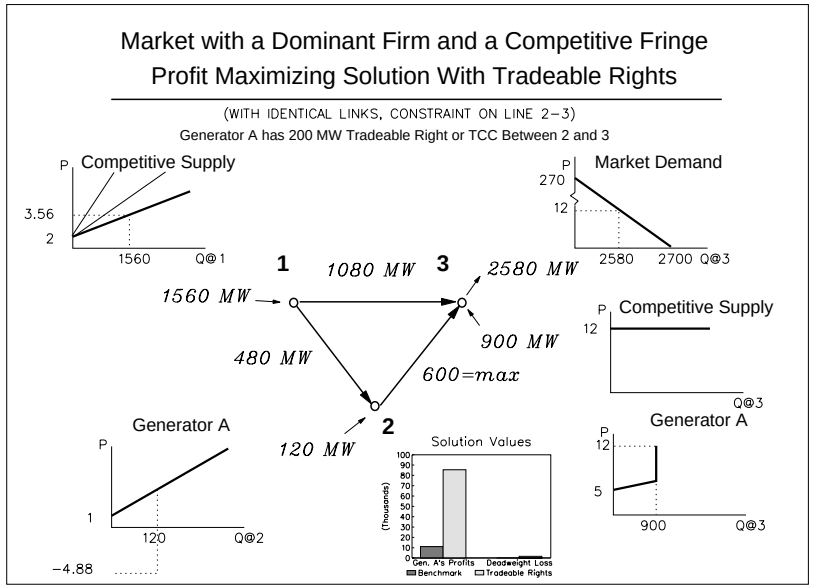
The results of Joskow and Tirole illustrate the sometimes surprising interactions between various elements of the markets, even without emphasizing strong interactions in the network.

- Ownership of transmission rights can have significant effects on the incentives to exercise market power in generation.
- The difference between financial rights and realistic physical rights is less than meets the eye. The principal distinction is the possibility of withholding physical rights, which would raise strong regulatory concerns.
- The direction of the effect on economic efficiency and the implications of the allocation of rents depend on the microstructure of market design.
- The basic insights of the analysis for their particular simplified radial model carryover into more complicated networks, but the presence of loop flow "further enriches the nature of the competitive interactions."

The first three points are amply demonstrated. The last is true for the simple cases analyzed, but the enrichment of interactions in networks may rise to the level of a qualitative difference.

Another example illustrates a case in a network where introduction of financial rights increases monopoly profits but also increases efficiency. This is in contrast to Figure 2 in J&T which implies that the no-rights solution is always the most efficient.





The case here differs J&T in that the monopolist controls generation at more than one location, and some of its generation is low cost. The details show financial contracts increase efficiency in this case.[1]

[1] Judith B. Cardell, Carrie Cullen Hitt, and William W. Hogan, "Market Power and Strategic Interaction in Electricity Networks," Resource and Energy Economics, Vol. 18, No. 4, 1997, pp. 107-141.

The results of Johnsen, Verma and Wolfram provide evidence of relatively greater exercise of local market power when constraints arise in the Norwegian network.

- Through a series of heroic assumptions, the authors isolate differences on differences that indicate an increase in the exercise of market power under conditions of lower demand elasticity and transmission constraints.
- The methodology is most plausible if we assume the unconstrained baseline is the competitive outcome.
- The results suggest that in one (Kristiansand) of five areas in Norway, there is statistically significant evidence of increased exercise of market power, at night under constrained conditions, with price plausibly increasing 15% over the baseline level.
- Three other regions (Bergen, Tromsø, Trondheim) show no consistent evidence of increased market power. The fifth (Oslo) suffers from the 'richness' of network interactions where "defining constraints becomes tricky," and was not reported.

The methodology is clever, and the results are persuasive within the framework of the strong assumptions. But we should ask: Does a 15% increase in price in one of the regions, for the 120 constrained nighttime hours in 1998, suggest a major policy problem? Would curing this disease kill the patient? We should look carefully at the side effects of any medicine we prescribe.

Supporting papers and additional detail can be obtained from the author. William W. Hogan is the Lucius N. Littauer Professor of Public Policy and Administration, John F. Kennedy School of Government, Harvard University. He is a Director of the Law and Economics Consulting Group in Navigant Consulting, Inc. This paper draws on work for the Harvard Electricity Policy Group and the Harvard-Japan Project on Energy and the Environment. The author is or has been a consultant on electric market reform and transmission issues for American National Power, British National Grid Company, Calpine Corporation, Commonwealth Edison Company, Detroit Edison Company, GPU Inc. (and the Supporting Companies of PJM), GPU PowerNet Pty Ltd, Duquesne Light Company, Electricity Corporation of New Zealand, Independent System Operator New England, National Independent Energy Producers, New England Power Company, New York Independent System Operator, New York Power Pool, New York Utilities Collaborative, Niagara Mohawk Corporation, PJM Office of Interconnection, Reliant Energy, San Diego Gas & Electric Corporation, Sempra Energy, Southern Energy, TransÉnergie, Transpower of New Zealand, TURN, UCAN, Westbrook Power, Williams Energy Group, Williams Energy Marketing and Trading, Wisconsin Electric Power Company. The views presented here are not necessarily attributable to any of those mentioned, and any remaining errors are solely the responsibility of the author. (http://ksgwww.harvard.edu/people/whogan)