Vertical Arrangements and Competition: Evidence from Electricity Markets

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Presentation based upon "Vertical Arrangements, Market Structure and Competition: An Analysis of US Restructured Electricity Markets" with Erin Mansur and Celeste Saravia

Outline

- Motivation
  - How do different market attributes interact in determining market competitiveness?
- Punchline
  - By traditional measures of horizontal market structure, California should have been the most competitive, not the least
  - vertical relationships played a key role in the “successful” markets
- General implications
- The details of the empirical study
- conclusions

Monthly Average Wholesale Electricity Prices

- PJM
- New England
- California

[Graph showing monthly average wholesale electricity prices for PJM, New England, and California]
The Challenge of Competitive Electricity Markets

- Lack of price-responsive demand
- Costly storage
- Frequently binding capacity constraints, long construction lead-times
  - Transmission
  - Generation
- Even firms with small market shares can enjoy substantial market power under the right (wrong) circumstances

New England Energy Clearing Price and MC

Average California PX price and MC
Kernel Regressions of Lerner Index vs. Capacity Ratio
(May - December 1999)

Kernel Regressions of Lerner Index vs. Capacity Ratio
(May - October 2000)

Market Comparisons
- Markets have experienced very different levels of prices
  - Counter-factual competitive prices can tell us the degree price exceeds these levels:
    - Borenstein, Bushnell, and Wolak and Joskow and Kahn on California
    - Bushnell and Saravia on New England
    - Mansur on PJM
- But why have they performed differently?
Forward Commitments and Oligopoly

• Forward contracts increase spot production
  - Less incentive to raise spot prices if most sales are already locked up under fixed-price contracts
• Desire to capture market from competition leads to equilibrium forward contracting by all firms
  - More output by all firms relative to when there is no forward market
• Pushing market forward allows for more supply and demand response
  - More potential suppliers

Vertical structure and forward commitments

• Usually we think of wholesale (upstream) price determining the (downstream) retail price
  - Issues are usually foreclosure, raising rivals costs vs. double marginalization
• In some markets, retailers make forward commitments to customers
  - Utilities - telecom services - construction
• In these markets a vertical arrangement plays the same role as a forward contract
  - A pro-competitive effect
  - A balanced generator-retailer does not have a big net position in the wholesale market

Retail and Generation in Great Britain, 2006
Market Comparisons

- Role of Vertical Arrangements
  - Almost no policy discussion of impact of retail policies on vertical arrangements like long term contracts and vertical integration.
    - California required divestiture and prohibited long term contracts (foreclosure concerns)
    - New England required “vesting” contracts
    - PJM firms remained vertically integrated in generation, transmission, and distribution
  - We ask: what is the relative influence of market rules, horizontal structure, and vertical arrangements on market performance

Approach

- abstract away from specific market rules and establish bounds on the potential scope of impact of those rules
- Bounds are established by horizontal structure and vertical arrangements

Supply Function Equilibrium

Green and Newbery (1992)
Green and Newbery (1992)

Bounds on Non-Cooperative Outcomes

Retail Obligations/Contracts Reduce Bounds
Methodology

- Data on spot price, quantity demanded, vertical commitments, and unit-specific marginal costs.
- Estimate supply of fringe firms.
  - Calculate residual demand.
- Simulate market outcomes under:
  - 1. Price taking behavior: \( P = C' \)
  - 2. Cournot behavior: \( P + P' q = C' \)
  - 3. Cournot behavior with vertical arrangements: \( P + P' (q-Q) = C' \)

Residual Demand function

- Source of "residual demand" price elasticity in model
- We observe import quantities, market price, and weather conditions in neighboring states

\[
\begin{align*}
\alpha_t &= Q^{\text{exp}}_t + \beta \ln(Q^{\text{exp}}_t) \\
\beta_t &= \exp\left(\frac{\alpha_t - Q^{\text{exp}}_t}{\beta}\right)
\end{align*}
\]

- The demand curve is fit through the observed price and quantity outcomes.
- Estimates of price responsiveness are greatest in California (\(\beta \approx 5400\)) relative to New England (\(\beta \approx 1180\)) and PJM (\(\beta \approx 860\)).

Prices by Quantity Demanded in California

Actual, Competitive, and Cournot Price Kernels

We calculate nonparametric regressions using the k-Nearest Neighbors estimator.
Price comparison on peak

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<thead>
<tr>
<th>Price</th>
<th>California</th>
<th>New England</th>
<th>PJM</th>
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<tbody>
<tr>
<td>Actual</td>
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<td>55</td>
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<tr>
<td>Competitive</td>
<td>35</td>
<td>39</td>
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<tr>
<td>Cournot</td>
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<td>Cournot (&quot;n.v.a.&quot;)</td>
<td>Same</td>
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Conclusions

• Horizontal structure alone does a very poor job describing the performance of US markets
• Vertical arrangements + horizontal structure massively reduces scope for market rules to impact outcomes, appear to explain performance pretty well
• Vertical arrangements are having a big impact on competition, market rules less so
• Key was that retail prices were constrained, making them similar to long-term fixed price contracts
  - In this case by regulatory transition mechanisms
  - A similar effect could apply for deregulated retail if retail prices are determined before wholesale prices