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

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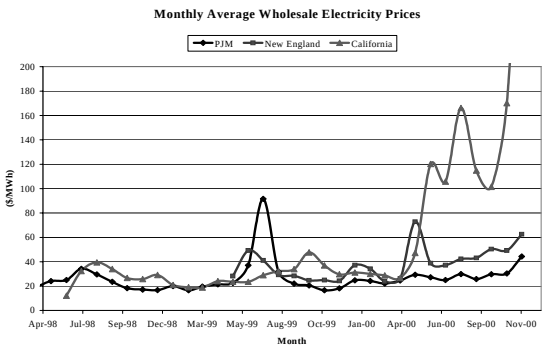

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The Challenge of Competitive Electricity Markets

- 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

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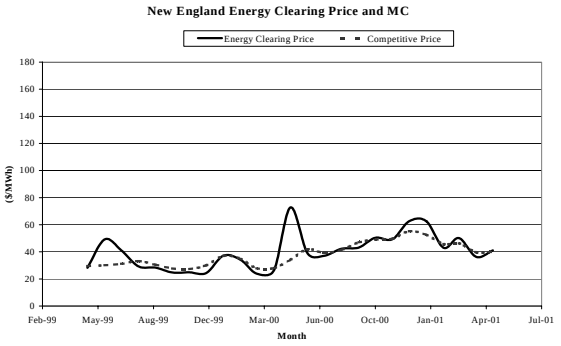

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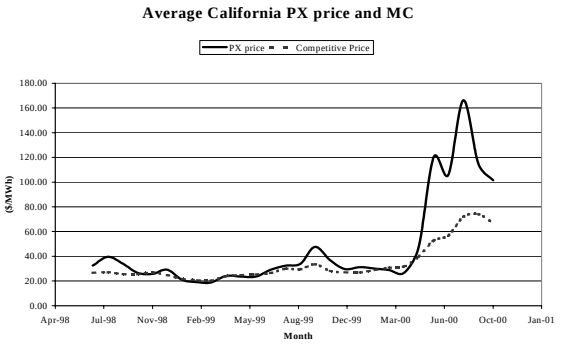

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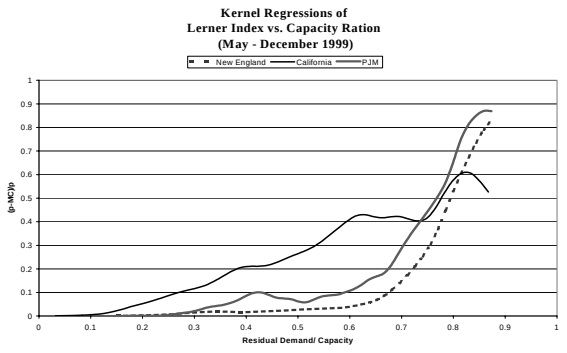

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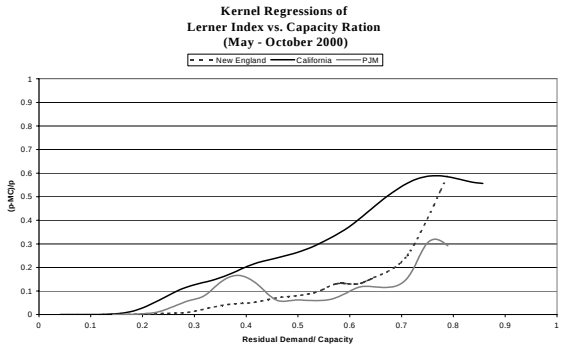

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Market Comparisons

- 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?

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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

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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

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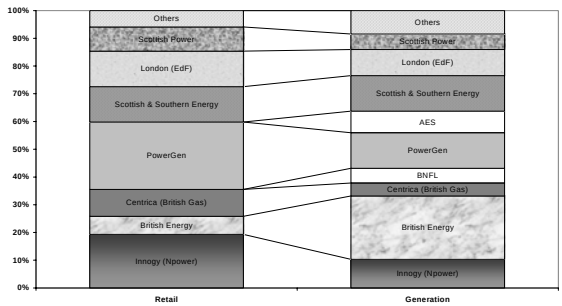
Retail and Generation in Great Britain, 2006



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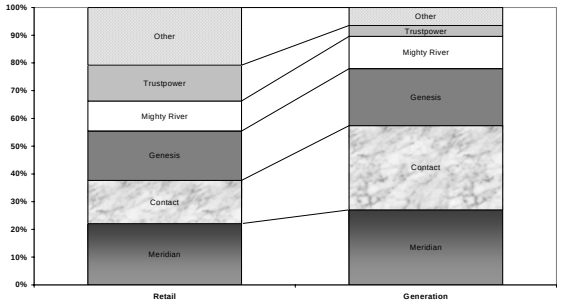
Retail and Generation in New Zealand, 2004



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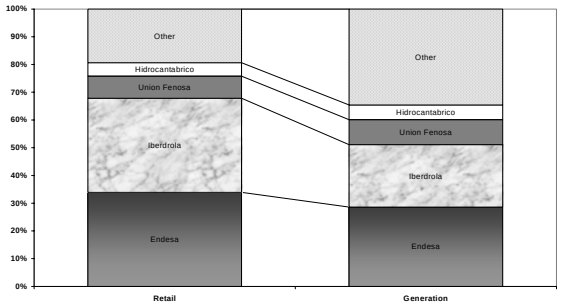
Retail and Generation in Spain, 2004



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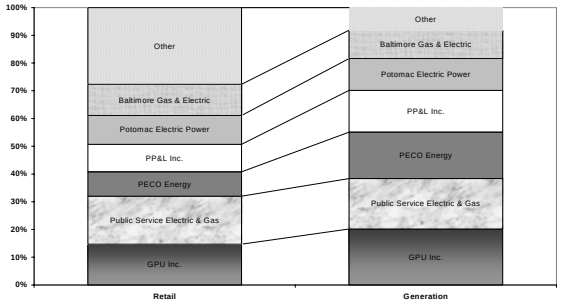
Retail and Generation in PJM, 1999



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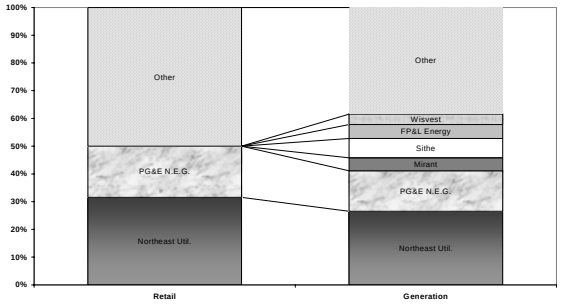
Retail and Generation in New England 1999



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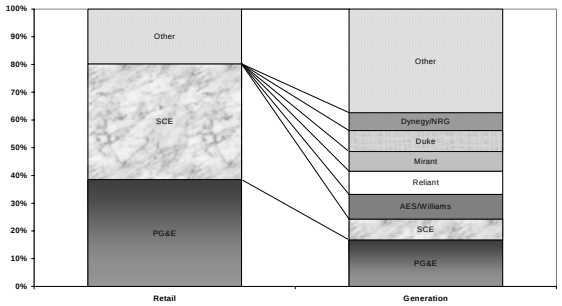
Retail and Generation in California 1999



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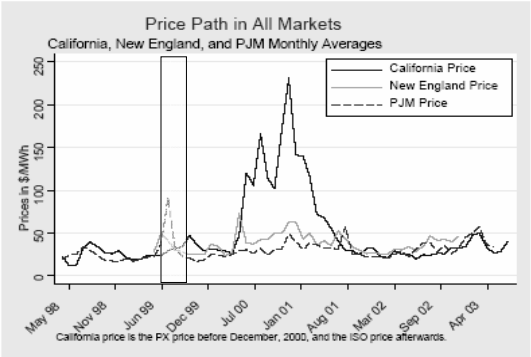

Market Comparisons

- 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

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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

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Supply Function Equilibrium

Green and Newbery (1992)

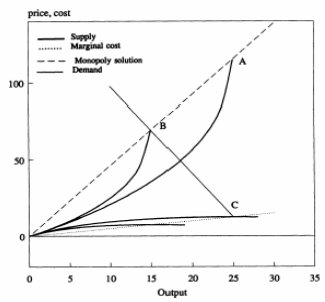

FIG. 3.—Feasible supply function equilibria

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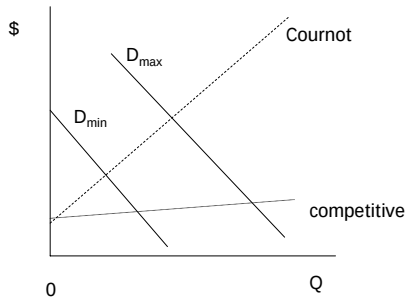
Green and Newbery (1992)



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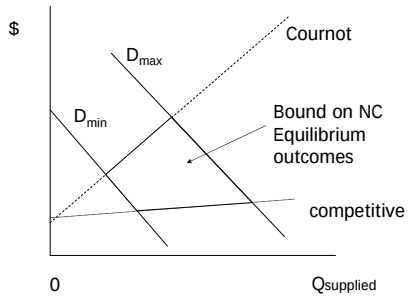
Bounds on Non-Cooperative Outcomes



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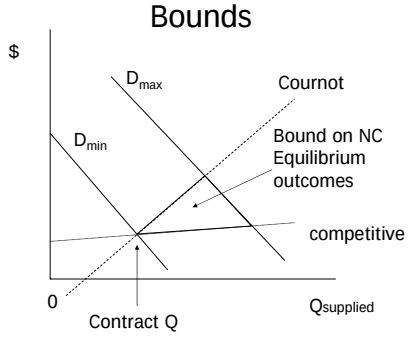
Retail Obligations/Contracts Reduce Bounds



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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 arraignments: $P + P' * (q-q^c) = C'$

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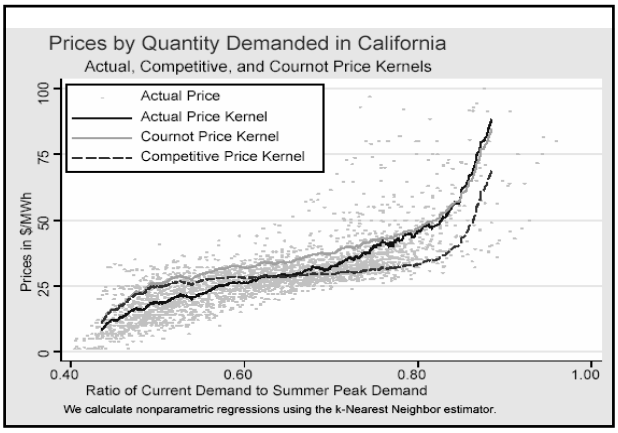
Residual Demand function

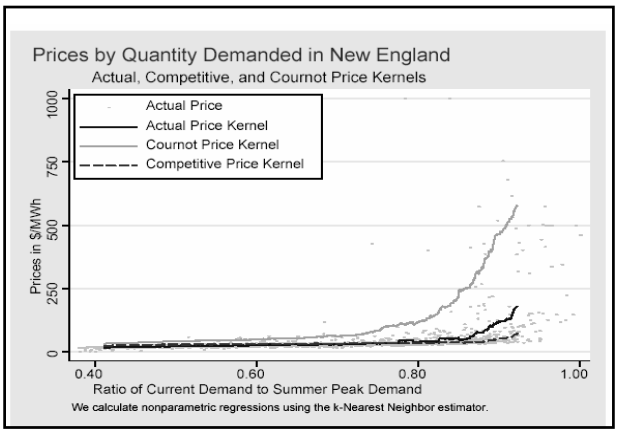
- Source of "residual demand" price elasticity in model
- We observe import quantities, market price, and weather conditions in neighboring states

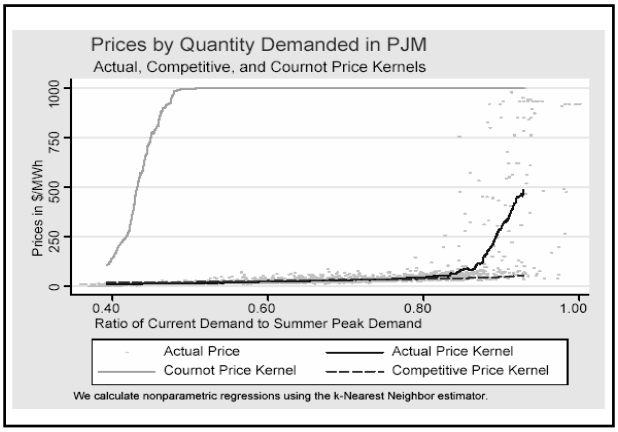
$$\alpha_t = Q_t^{actual} + \beta \ln(p_t^{actual})$$

$$p_t = \exp\left(\frac{\alpha_t - Q_t}{\beta}\right)$$

- 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 New England
Actual, Competitive, and Cournot Price Kernels
Actual Price
Actual Price Kernel
Cournot Price Kernel
Competitive Price Kernel
Prices in $/MWh
0
250
500
750
1000
0.40
0.60
0.80
1.00
Ratio of Current Demand to Summer Peak Demand
We calculate nonparametric regressions using the k-Nearest Neighbor estimator.


Prices by Quantity Demanded in PJM
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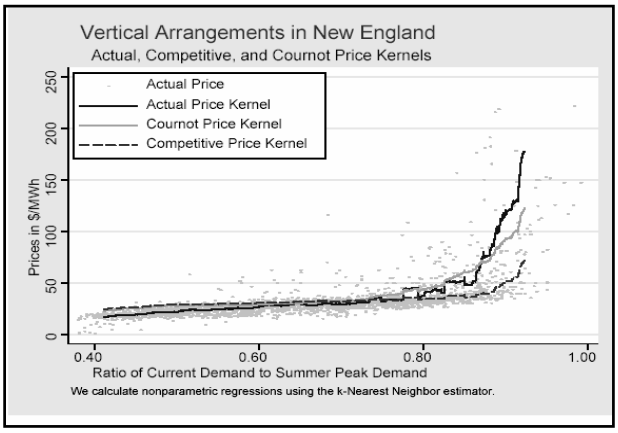
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Actual Price Kernel
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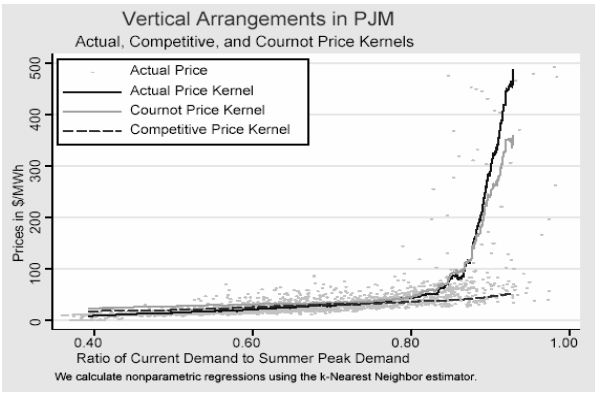

Price comparison on peak

Price	California	New England	PJM
Actual	43	55	97
Competitive	35	39	35
Cournot	45	53	87
Cournot ("n.v.a.")	Same	246	1000

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Price comparison off peak

Price	California	New England	PJM
Actual	24	29	24
Competitive	26	31	25
Cournot	30	31	33
Cournot ("n.v.a.")	Same	98	901

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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

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