Retail Electric Competition and Free Interstate Trade in the Southeast

While free trade leads to overall welfare gains, there will be losers as well as winners with retail electric competition and interstate trade. In low-price states, producers win but consumers lose, and the opposite occurs in high-price states. Unusual coalitions can be expected to form as the debate over retail competition evolves.

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I. Introduction

Retail electric competition has been touted as having the potential to lower electricity prices across the country. The motivation behind retail competition has been to give consumers a choice among suppliers with the idea they would force more competition onto the industry. The less-touted flip side of "consumer choice" is "producer choice."[1] Producers in low-price states, freed of any obligation to serve native load in their traditional franchise area, would choose to export to customers in high-price states. In the high-price states, imports would lead to falling prices, while in the low-price states export demand would put upward pressure on prices. Across states, prices would tend to converge as the level of interstate trade increased subject to transmission constraints and the evolving regulatory regime.

Retail competition has been touted as leading to nationwide price decreases of 25 percent due to peak load pricing and smoothing over production cycles.[2] Free trade would tend to mitigate the effect of peak load price spikes by diverting load through the interstate system. Average price reductions, however, depend on price elasticities of demand and the degree of consumption smoothing. The focus on an average national price disguises the fact that prices might rise in some states.

A 1997 article in *The Electricity Journal* pointed out that competition could cause utilities in low-price states to ration output by raising prices.[3] Studies out of low-price states (Alabama, Kentucky, and South Carolina) predict that retail competition will cause higher prices in their states.[4] A study on the Indiana market makes the points that some states would experience higher prices with free interstate trade and the only sure winners would be residential customers in high-price states.[5] Regarding the limits of transmission, a transmission network model of the New England Power Pool finds that minimum generation is more binding than transmission constraints in determining price convergence.[6] Short of retail competition, the Energy Information Agency has predicted wholesale competition would reduce the national average price of electricity by $0.003/kWh through 2005, with Southeast prices converging as they fall.[7] The Department of Energy (DOE) predicts increases in coal-fired and natural gas generation in the Southeast through 2015. The DOE also predicts consumers in every region will enjoy lower prices with retail competition but projections of regional prices are higher than present prices in some states.[8] Moreover, an unreleased Department of Agriculture study using a DOE model evidently forecasts higher prices for residential consumers in 19 states.

Without any doubt, free electricity trade over the entire U.S. would increase national welfare even with existing generation capacity.[9] The distribution of gains, however, would be uneven and consumers in some states would be worse off. The present article focuses on these interstate distributional effects. Suppliers in exporting states will enjoy increased demand and higher prices, and consumers in importing states will enjoy lower prices. The losers would be consumers in exporting states and suppliers in high-cost states facing increased import competition. These are the essential effects of free trade and the present model focuses on these effects in the Southeast.[10]

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The present study begins by examining the pattern of interstate prices and trade. A model with perfect arbitrage in the Southeastern Electric Reliability Council and Florida projects the potential impact of free interstate trade.[11] Transmission bottlenecks might limit the volume of interstate transmission but marginal sales determine prices in competitive markets and even a small volume of trade could have significant price effects.[12] The present model is meant to provide an indication of the potential of interstate trade short of increased investment in generation. Results offer perspective for the claim that retail competition will lower prices for all electric consumers.

II. Some Background on Interstate Electricity Trade

Table 1 presents generation and consumption derived from EIA data in 1997. States are roughly separated by Reliability Councils (RCs) and ranked by net exports relative to generation. The reported ''price'' in $/kWh is the average revenue across consumer classes. States with higher prices tend to be net importers. Net exports for the RCs are reported below the acronyms: Southeastern Electric Reliability Council (SERC), Florida Reliability Coordinating Council (FRCC), Southwest Power Pool (SPP), Mid-America Inter-connected Network (MAIN), East Central Area Reliability Coordination Agreement (ECAR), Mid-Atlantic Area Council (MAAC), Northeast

Table 1: Net Exports by State (million MWh, 1997)

		Generation	Consumption	Export	Export/Generation	$/kWh
SERC, FRCC	VA	59	87	−28	−0.48	$0.061
−5	FL	148	175	−27	−0.18	$0.072
	MS	31	39	−8	−0.27	$0.059
	NC	107	108	−1	−0.01	$0.065
	GA	102	100	1	0.01	$0.064
	TN	93	86	7	0.08	$0.053
	SC	78	68	11	0.14	$0.055
	AL	114	73	40	0.35	$0.053
SPP	LA	61	75	−14	−0.23	$0.060
−4	OK	48	44	4	0.09	$0.054
	KA	38	32	6	0.15	$0.063
	AK	43	36	6	0.15	$0.062
MAIN	WI	49	60	−11	−0.24	$0.052
−2	IA	34	36	−2	−0.05	$0.060
	IL	131	126	5	0.04	$0.077
	MO	71	65	6	0.08	$0.061
ECAR	OH	141	157	−15	−0.11	$0.063
78	MI	90	97	−7	−0.08	$0.070
	KY	92	76	16	0.17	$0.040
	IN	110	88	22	0.20	$0.053
	WV	88	26	62	0.70	$0.050
MAAC	NJ	24	66	−43	−1.8	$0.105
−4	MD	45	56	−12	−0.27	$0.070
	PA	177	127	51	0.29	$0.080
NPCC	ME	3	12	−9	−2.7	$0.095
−63	CT	13	38	−15	−1.1	$0.105
	RI	4	7	−3	−0.86	$0.107
	DE	7	10	−3	−0.53	$0.070
	MA	34	48	−14	−0.40	$0.105
	NY	108	132	−24	−0.22	$0.111
	VT	5	5	0	0.01	$0.099
	NH	14	9	5	0.36	$0.117
MAPP	MN	40	55	−15	−0.37	$0.056
17	NE	28	23	5	0.20	$0.053
	SD	12	8	5	0.38	$0.062
	ND	30	8	22	0.73	$0.057
WSCC	CA	112	224	−117	−1.0	$0.095
0	ID	14	21	−8	−0.58	$0.039
	CO	34	38	−3	−0.10	$0.060
	NV	23	24	−1	−0.04	$0.056
	OR	49	42	2	0.04	$0.046

Power Coordinating Council (NPCC), Mid-continent Area Power Pool (MAPP), Western Systems Coordinating Council (WSCC), and Electric Reliability Council of Texas (ERCOT).

Obvious trade patterns emerge. There is generally balanced trade between states inside the RCs with two exceptions. There are large exports from West Virginia, Indiana, and Kentucky toward the Northeast. Also, Florida and Virginia are net importers from Alabama and South Carolina. In the West, California essentially imports all of the exports from other states.

Evolving wholesale competition involves the market for bulk electricity with any generator in principle having access to regulated monopoly transmission systems. With retail competition, utilities in low-price states might be relieved of obligation to serve native load inside their traditional franchise areas.[13] Transmission interfaces would become more critical and interstate shipments would remain subject to uncertain regional or national regulation. Nevertheless, with retail competition underlying market forces would ultimately tend to shape the evolution of interstate trade and local prices.

With trade, price changes and the level of trade depend partly on the price elasticity of demand.[14] Estimates of the price elasticity of demand for electricity in the literature vary from roughly −0.5 to −1.0 depending on the amount of time allowed for adjustment, the consumer groups

Table 1: ***(Continued)***

		Generation	Consumption	Export	Export/Generation	$/kWh
	WA	117	85	32	0.28	$0.040
	AZ	78	54	24	0.31	$0.074
	UT	34	20	14	0.40	$0.052
	NM	31	17	13	0.44	$0.068
	MT	28	12	15	0.55	$0.052
	WY	41	12	29	0.70	$0.043
ERCOT	TX	277	285	−8	−0.03	$0.062

included, and so on. The following simulations include this range of price elasticity of demand.

III. Interstate Electricity Trade in the Southeast

If transmission systems were perfect and markets not segmented by customer class, retail competition and arbitrage would imply equal prices across states. The following idealized model is proposed to acquire some appreciation for the potential of retail competition and interstate trade.

The first columns in **Table 2** list prices, consumption, and net exports in the Southeast with states arranged by average price. At the low extreme, Alabama has an average price of $0.053 and exports 35 percent of its production. At the other extreme, Florida has the highest average price at $0.072 and imports 15 percent of its consumption. Tennessee and South Carolina are both low-price states and net exporters.[15] Virginia has a relatively high level of imports and an intermediate price. Georgia and North Carolina have slightly higher prices and little net trade.

For present purposes, assume generation and net trade with other regions are fixed. Under these assumptions, total consumption in the Southeast would remain at 732.8 million mWh and net imports from the rest of the country would remain at 5 million mWh. Assuming free transmission inside the Southeast, retail competition and free trade would redistribute electricity and equalize prices across states. Alternatively, with imperfect transmission, price differences would persist to some extent.[16] The interstate trade model is flexible and can accommodate such engineering structure. For present purposes, however, assume perfect transmission.

Adjustments in price and consumption across states would depend on the price elasticity of demand. To gauge sensitivity, the present study reports simulations with price elasticities of demand of −0.5 and −1.0. The model imposes arc elasticities on initial prices, final prices, and consumption levels in each state.[17] The model solves for consumption levels that would equalize prices across states and

Table 2: Adjustment to Free Interstate Trade in the Southeast

	1997			Elasticity = −0.5 (p = $0.0620)		Elasticity = −1.0 (p = $0.0619)	
	Price	Consumption	Net Export	Consumption	Net Export	Consumption	Net Export
AL	$0.053	73.4	40.3	67.9	45.8	62.8	50.9
TN	$0.053	86.0	7.3	79.5	13.8	73.6	19.7
SC	$0.055	67.8	10.6	63.8	14.6	60.2	18.2
MS	$0.059	39.5	−8.3	38.5	−7.3	34.2	−3.0
VA	$0.061	87.2	−28.2	86.5	−27.5	85.9	−26.9
GA	$0.064	100.4	1.4	102.0	−0.2	103.8	−2.0
NC	$0.065	108.4	−1.0	111.0	−3.6	113.8	−6.4
FL	$0.072	175.1	−27.1	188.6	−40.6	203.6	−55.6
Total		732.8	−5.0	732.8	−5.0	732.8	−5.0

leave total generation and consumption unchanged. These predicted changes in consumption and net exports are reported in the second and third sets of columns in Table 2.

With a price elasticity of demand of −0.5, prices move to $0.0620 in every state. For Alabama and Tennessee, the lowest-price states, this would be a 17 percent increase. For Florida, this would be a 14 percent decrease. Consumption would adjust in each state to the new price. The three major exporting states, Alabama, Tennessee, and South Carolina, would consume less and export more. In Alabama, consumption would fall 7 percent while exports rose 14 percent. In Tennessee, consumption would fall 8 percent as exports rose 89 percent. Exports in Tennessee start from a lower level perhaps due in part to the Tennessee Valley Authority ''fence.'' In South Carolina, consumption would drop 6 percent and exports would rise 38 percent.

On the importing end, consumption would rise 8 percent in Florida as imports jump 50 percent. In North Carolina and Georgia, consumption would rise 2 percent. Georgia would switch from being a slight net exporter to a marginal net importer, with an increase of 1.6 percent in consumption. In North Carolina, imports would jump 260 percent although the level of imports would remain only 3 percent of consumption. In contrast, Florida imports would jump from 15 to 22 percent of consumption. Mississippi would see net imports fall 12 percent as consumption fell 3 percent. Similarly, in Virginia imports would fall 3 percent as consumption fell 1 percent.

The big story would be increased net imports into Florida from Alabama, South Carolina, and Tennessee. Price changes in these states would appear to be large enough to affect residential, commercial, and industrial customers. Whether these price changes would alter the pattern of industrial production is worth investigating. There is some evidence that ''energy intensive'' industries presently tend to locate in the low-price states.[18] The evolving competition for large bulk customers will be important to the industry.

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Given the assumption of fixed generation, price changes translate into equivalent percentage changes in generation revenue. Given the −0.5 price elasticity of demand, generation revenue would increase 17 percent in Alabama and Tennessee and 13 percent in South Carolina. In Florida, revenue for native generators would fall 14 percent. It is easy to anticipate a coalition of consumers in high-price states and producers in low-price states favoring retail competition.

With a price elasticity of −1.0, consumption and trade adjustments are larger. The average price would move to $0.0619 in each state, almost identical to the regional price with an elasticity of −0.5. Differences in excess demands match excess supplies across states with either elasticity. At one extreme, Alabama exports would rise 26 percent and consumption would fall 14 percent. South Carolina exports would rise 72 percent and consumption would fall 11 percent. At the other extreme, Florida imports would rise 105 percent, consumption would increase 16 percent, and price would fall 14 percent. In Georgia and Virginia, neither consumers nor producers would notice much change with regional retail competition. Mississippi would see higher prices and decreased imports. North Carolina would experience a small price decline and some increased consumption.

Including customer classes would enrich the model. Residential, commercial, and industrial customers face different contract arrangements and prices vary a great deal across classes. The present model implicitly assumes the ratio of industrial to residential prices remains constant across states. In applications, competition could be introduced in stages with increased interstate trade in industrial electricity but

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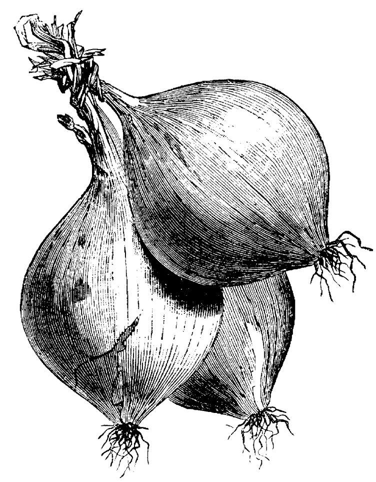
regulated franchises for residential electricity.[19]

Increased generation capacity can be included in the model. Every 1 percent increase in generation would result in a 2 percent reduction in the regional price given a −0.5 price elasticity of demand. A capacity increase of 10 percent in the Southeast to a total of 807 million mWh would cause the regional free trade price to fall from $0.062 to $0.051. Regional generation would have to increase 8.3 percent to return prices in Alabama and Tennessee to their 1997 level given free trade.

IV. Caveats and Extensions

As noted above, the present model is based on simplifying assumptions that may not conform completely to real world conditions. There are transmission bottlenecks and transmission is not costless, impeding interstate price equalization. On the other hand, increased use of distributed generation and improvements in transmission networks are both likely with retail competition and will offset transmission bottlenecks.

The present model does not consider innovations in peak load pricing and market segmentation that could develop with retail competition. It is perhaps likely that pricing innovations under competition will result in increased capacity utilization for more cost-effective generators. One consequence would be convergence of prices toward a price lower than in the present model. Exporting states would have smaller price increases and importing states larger price decreases than in the present model. Despite these caveats, it is likely that substantial price equalization will occur across states with retail competition and



that some states will experience price increases.

Price equalization has implications for economic development and environmental quality. High-price states would generate a smaller share of their total electricity consumption while low-price states would generate relatively more. Redistribution of generation among states implies a redistribution of the associated pollutants. Further, the low relative price of electricity has been important in attracting industry to low-price states and price equalization would reduce this advantage. Retail competition could produce a triple whammy for low-price states: higher electricity prices, less industrial development, and lower air quality.

V. Conclusion

The present arbitrage model stresses the potential of ''producer choice'' in retail electric competition. While free trade leads to overall welfare gains, there will be losers as well as winners with retail electric competition and interstate trade. In low-price states, producers win but consumers lose, and the opposite occurs in high-price states. Unusual coalitions can be expected to form as the debate over retail competition evolves.

The present model assumes perfect arbitrage and is subject to qualifications. In the Southeast, some increase in interstate transmission is feasible although transmission bottlenecks would limit the volume of trade. Small changes in the volume of trade, however, can lead to large price changes because marginal sales determine prices in competitive markets. Other qualifications for the present model include bilateral trade, pricing schemes, wholesale pricing, variation in customer classes, and uncertain regulation. Nevertheless, the present model illustrates that neither all consumers nor all producers can expect to gain with retail competition.■

Endnotes:

1. ''Producer choice'' presupposes only competition, not market power.

Rivalry between consumers and producers, with consumers attempting to negotiate or locate the lowest offer and producers attempting to negotiate or locate the highest bid, leads to the arbitrage assumed in the present article.

2. M. Maloney and R. McCormick, *Customer Choice, Consumer Value: An Analysis of Retail Competition in America's Electric Industry*, Citizens for a Sound Economy, 1996, available at http://hubcap.clemson.edu/customerchoice/customer.doc (accessed Jan. 21, 2002).

3. B. Biewald, *Competition and Clean Air: The Operating Economies of Electricity Generation*, ELEC. J., Jan. 1997, at 41–45.

4. A.H. Barnett, H. Thompson, S. Addy, and A. Ijaz, *Economic Impact of Retail Competition in Alabama*, 1998, available at http://www.auburn.edu/outreach/edi/research.html (accessed Jan. 21, 2002); D. Freshwater, S. Goet, S. Samson, J. Stone, T. Johansson, and M. Greer, *The Consequences of Changing Electricity Regulations for Rural Communities in Kentucky*, 1997, at http://www.rural.org/publications/nreca.html (accessed Jan. 21, 2002); J. Clifton, R. Wilder, and D. Woodward, *Whither Electricity Deregulation: What are the Issues and Implications for South Carolina?* 1997, available at http://research.badm.sc.edu/research/bereview/be43_4/electr.htm (accessed Jan. 21, 2002).

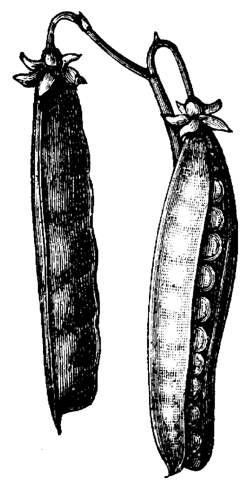
5. F.T. Sparrow, F. Holland, D. Gotham, Z. Yu, P. Sanders, and K. Stamber, *The Projected Impact of Restructuring in Indiana Electricity Prices: An Interim Report*, 1998, State Utility Forecasting Group, Purdue University, available at http://iies.www.ecn.purdue.edu/IIES/SUFG/Publications (accessed Jan. 21, 2002).

6. J. Hewlett, D. Hale, T. Luong, and R. Enyon, *An Exploration of Network Modeling: The Case of NEPOOL*, 1998, available at http://www.eia.doe.gov/oiaf/archive/issues98/nepool.html (accessed Jan. 21, 2002).

7. Energy Information Administration, *Annual Energy Outlook 1998*, and *Electricity Prices in a Competitive Environment*, both published in 1997 by DOE.

8. Energy Information Administration, *The Comprehensive Electricity Competition Act: A Comparison of Model Results*, 1999, available at www.eia.doe.gov/oiaf/servicerpt/ceca/ceca.html (accessed Jan. 21, 2002).

9. Two points should be addressed. First, the increase in total welfare, absent increased capacity, assumes utilities exercise some degree of market power. Second, native load requirements become critical. If states allow retail competition but maintain some "provider of last resort" requirement, utilities would have to use excess capacity or build new generation for export.



10. An ultimate outcome of free trade would be movement of electricity production. While there are physical and regulatory limits on the location of generation, free trade should lead to locating plants where inputs are cheapest. Examples may include locating natural gas generation along the Gulf Coast or coal generation in Kentucky and North Alabama.

11. The Southeastern Electric Reliability Council (SERC) is examined because it is considered an interconnected transmission grid. Florida is included because it is involved with interstate trade moving through SERC. Similar models can be constructed for other regions.

12. E. Leckey and D. Hale, in an analysis report for the Department of Energy's Energy Information Agency, show that transmission bottlenecks do not substantially affect the benefits of trade among surrounding regions in a study of NEPOOL, suggesting that electricity prices would tend to converge throughout a region. R. Enyon, T. Leckey, and D. Hale, *The Electric Transmission Network: A Multi-Region Analysis*, Energy Information Agency, 2000, available at http://www.eia.doe.gov/oiaf/analysispaper/transmiss.html (accessed Jan. 21, 2002).

13. As stated before, this does not have to be the case. If a state maintains a requirement of serving native load, there might be trade without full price convergence.

14. Elasticity is a measure of responsiveness between variables. Price elasticity of demand is the percentage change in quantity demanded due to a percentage change in price.

15. Tennessee is a special case because of the Tennessee Valley Authority (TVA). An increasing debt burden from uncompleted projects and cost overruns suggest higher rates for TVA customers over the coming years.

16. Transmission interfaces between systems in a competitive industry will become crucial with retail competition. Interstate shipments would likely be subject to regional regulation. The critical interfaces will be those between distribution areas. Vertically integrated owners of transmission have an incentive to impede the transmission of a competitor's electricity. Divestiture of transmission from generation and retail sales may be required to prevent anticompetitive behavior.

17. Arc elasticities measure responsiveness in terms of average price changes and average quantity changes, eliminating "directional" differences associated with relatively large price changes.

18. Industries that rely heavily on electricity input tend to locate where that resource is cheapest, i.e., the low-price states. As prices adjust through arbitrage these states would lose this source of comparative advantage in relative to other states.

19. This has been observed, at some level, in state regulation. Border or hook-up competition is an example of a regulatory regime with varying degrees of "choice" for industrial relative to residential customers.