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Regulatory Regimes and Electricity Pricing for Manufacturing Customers

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Abstract

We use a large customer-level database covering the years 1963 to 2006 to study the relationship between regulatory regimes and electricity prices for manufacturing customers. In previous work, we documented large electricity price differences among industrial customers. We found that this variation is associated with spatial differences as well as substantial differences in prices within utilities across customers with different purchase quantities. The latter is associated with the prevailing pattern within utilities of quantity discounts in the pricing structure to industrial customers. We also found over the last few decades a large compression of the price differences across industrial customers with the timing of the compression concentrated in the 1970s. Consistent with this compression, in the 1970s the electricity price-quantity schedule flattened dramatically within utilities. While we found evidence supporting a cost-based rationale for quantity discounts in electricity pricing, there are also regulatory forces at work. In this paper, we investigate the impact of two aspects of regulatory regimes on the electricity pricing structure. First, we compare the electricity pricing structure across states with elected versus appointed public utility commissions. Second, we look for changes in the structure of electricity prices in response to state-level restructuring of electricity markets. Between 1998 and 2002, 19 states and the District of Columbia introduced retail competition for industrial customers. Our data span this period of deregulation and the variation across states and time provides considerable scope for exploring the impact of this deregulation on the structure of electricity prices across industrial customers.

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1. Introduction

Regulatory regimes play a large part in determining the structure of electricity prices in the U.S. Electricity markets in the U.S. are, for the most part, still regulated despite the deregulation that has gone on over the last 25 years in other sectors of the economy, including airlines, telecommunications and natural gas.[1]

We use a large customer-level database covering the years 1963 to 2006 to study the relationship between regulatory regimes and electricity prices for industrial customers. In previous work, Davis et al. (2008), we documented large electricity price differences among industrial customers. We found that this variation is associated with spatial differences as well as substantial differences in prices within utilities across customers with different purchase quantities. The latter is associated with the prevailing pattern within utilities of quantity discounts in the pricing structure to industrial customers. Over the last few decades we found a large compression of the price differences across industrial customers with the timing of the compression concentrated in the 1970s. Consistent with this compression, in the 1970s the electricity price-quantity schedule flattened dramatically within utilities. While we found evidence supporting a cost-based rationale for quantity discounts in electricity pricing, there are also regulatory forces at work.

In this paper, we investigate the impact of two aspects of regulatory regimes on the electricity pricing structure. First, we compare the electricity pricing structure across states with elected versus appointed public utility commissions. Second, we look for changes in the structure of electricity prices in response to state-level restructuring of

[1] See Joskow (2005) for a description of why electricity markets have been difficult to deregulate.

electricity markets. Between 1998 and 2002, 19 states and the District of Columbia introduced retail competition for industrial customers. Our primary database – Prices and Quantities of Electricity in Manufacturing (PQEM) – spans this period of deregulation and the variation across states and time provides considerable scope for exploring the impact of this deregulation on the structure of electricity prices across industrial customers. For this study, we integrate data on regulatory regimes into the PQEM database.

The paper proceeds as follows. Section 2 discusses the PQEM database and the external data we have on regulatory regimes. The following section discusses some basic facts about electricity prices. Section 4 explores the relationship between regulatory regimes and electricity prices, and the final section concludes.

2. Data

2.1 The PQEM Database

There are more than 2.1 million annual customer-level observations in the PQEM database, which derives principally from the U.S. Census Bureau's Annual Survey of Manufactures (ASM) and various data files provided by the Energy Information Administration (EIA). The ASM is a series of nationally representative, five-year panels that are refreshed by births as the panel ages. Large manufacturing plants are sampled with certainty, and smaller plants with at least 5 employees are sampled randomly with probabilities that increase with the number of employees. ASM plants account for about one-sixth of all manufacturing plants and about three-quarters of manufacturing employment. ASM plants report expenditures for purchased electricity during the calendar year and annual purchases in kilowatt-hours. The PQEM database includes data on electricity expenditures, purchases (kilowatt-hours) and other variables for more than 48,000 manufacturing plants per year, linked to additional data on the utilities that supply electricity. EIA data provides information on individual electric utilities and fuel sources for electricity generation by state. Plants are linked to the electric utility that serves them based on physical location. We use ASM sample weights throughout our analysis so that results are nationally representative. See Davis et al. (2007) for more details on the PQEM database.

Table 1 reports selected characteristics of the PQEM. The database contains more than 2 million plant-level observations over the period from 1963 to 2006. There are 3,040 counties with manufacturing plants and 702 utilities, counting multi-state utilities once for each state in which they sell to industrial customers. The table shows that electricity purchases and cost shares vary enormously across manufacturing plants. For example, the 90th quantile of the purchases distribution is over 350 times the 10th quantile on a shipments-weighted basis and 615 times on a purchase-weighted basis. The median ratio of electricity costs to labor costs is 4.8% on a shipments-weighted basis and 17.8% on a purchase-weighted basis. While electricity costs are a modest percentage of labor costs for most plants, the top quartile (decile) of purchasers have labor costs that exceed 61% (197%) of labor costs. In other words, a large fraction of electricity is purchased by plants for which electric power is a primary or major cost of production.

2.2 Selection of Public Utility Commissions

Historically, the electric power industry in the U.S. has been regulated primarily at the state level by state public utility commissions.[2] Every state has some type of public utility commission.[3] One of the primary functions of these commissions is to approve changes in the electricity prices charged by the electric utilities.[4] Selection methods for these commissions vary across states. Public utility commissions are either appointed, often by the governor, or elected.

For this study, we integrate data on the selection of public utility commissions into the PQEM database. We include data from Besley and Coate (2000) on whether state public utility commissions are elected or appointed.[5] Figure 1 and Table 2 show the method of selection of the public utility commissions by state for 1960-2006. Public utility commissions are elected in all years in 11 (21.5%) states and appointed in all years in 34 (66.7%) states. The method of selection for public utility commissions changes during our time period for 6 (11.8%) states.

2.3 Electricity Market Deregulation

In the mid-1990s, several states began to consider deregulation of their retail markets for electricity. According to Joskow (2005), the impetus for this movement towards deregulation was the continued increase in real electricity prices in some states,

[2] There is also a federal body to regulate energy industries in the U.S., the Federal Energy Regulatory Commission (FERC). However, the powers of FERC are limited. Additionally, the U.S. Congress passed legislation affecting electricity markets in the 1990s, but this legislation did not call for comprehensive restructuring. See Joskow (2005) for a description of this legislation and FERC's actions.
[3] See the National Association of Regulatory Commissioners Web site (http://www.naruc.org) for a complete list of state utility commissions.
[4] See Joskow (1989) for a description of the functions of state public utility commissions.
[5] We augment the data in Appendix Table 2 of Besley and Coate (2000) with information from *The Book of the States* (1960-2007), and various public utility commission Web sites (cited in the notes for Table 2).

such as California and states in New England, while real electricity prices were falling in other parts of the country.

We integrate EIA data on the timing of state-level retail electricity market deregulation. Table 3 shows a list of the 25 states that passed legislation for retail electricity market deregulation, the year the legislation was passed, and the year restructuring was enacted for commercial and industrial customers. Five of these states, Arkansas, Montana, New Mexico, Oklahoma, and West Virginia, never actually implemented their deregulation legislation. In all, 20 (39%) states deregulated retail electricity markets between 1998 and 2002. Figure 2 shows the state of retail electricity market deregulation by state as of 2006. Retail electricity market deregulation has not been an unqualified success.[6] Several states have suspended or reversed their deregulation. For example, California suspended their deregulation program in September 2001, and Virginia passed legislation in 2007 to re-establish retail rate regulation.

3. Electricity Prices: Basic Facts

After trending down for nearly a century, real electricity prices began to rise after 1973. They continued to rise for about ten years and then resumed the historical pattern of steady declines until the increase in recent years. Figure 3 shows real electricity prices by end-user group from 1960 to 2006.[7] The price measure calculated from the PQEM

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[6] See Joskow (2005) for a discussion of electricity market deregulation.

[7] The electricity price series in Figure 3 for the residential, commercial and industrial sectors are from the Energy Information Administration (EIA), and the two series for the manufacturing sector are constructed from the PQEM. The EIA data rely on reports from electric utilities, and the PQEM data rely on reports from electricity customers (manufacturing plants). EIA prices are calculated as revenue from retail electricity sales divided by kilowatt hours delivered to retail customers. Real prices are calculated using the BEA implicit price deflator for GDP (2000 = 100). In the EIA data, the industrial sector encompasses manufacturing, mining, construction and agriculture.

database is the ratio of the plant's annual expenditures on electricity to its annual purchase quantity (watt-hours).

Figure 4 shows dispersion in log electricity prices among U.S. manufacturing plants from 1963 to 2006. There is, as we show in previous work (Davis et al. (2008)), tremendous dispersion in electricity prices paid by manufacturing plants. The purchase-weighted standard deviation exceeds 35 log points in all years and is as high as 55 log points in some years.[8] Figure 4 also shows substantial variation in dispersion over time. As emphasized in Davis et al. (2008), there is a great compression in electricity price dispersion in the 1970s on both a shipments- and purchase-weighted basis. Interestingly, the patterns of dispersion move in roughly opposite directions after the 1990s depending on whether the dispersion is on a shipments- or purchase-weighted basis. Dispersion rises on a shipments-weighted basis, but declines on a purchase-weighted basis, especially over the period from the mid 1990s to 2006.[9]

A large part of the dispersion in seen in Figure 4 reflects spatial differences in the electricity prices paid by U.S. manufacturing plants. However, quantity discounts also play a role in electricity price dispersion. In Davis et al. (2008), we show that sharp erosion in quantity discounts accounts for the compression in the electricity price distribution that occurred between 1967 and the late 1970s. As the overall dispersion in electricity prices drops over time, spatial price differences explain a larger portion of the remaining dispersion. For example, between state variation accounts for around 12% of

[8] We define 'purchase-weighted' as weighting by the plant's ASM sample weight times the plant's quantity of electricity purchases and 'shipments-weighted' as weighting by the plant's ASM sample weight times the plant's total value of shipments.

[9] Our previous work (Davis et al. (2008)) examined electricity price variation for the period 1963-2000. While the divergent patterns on a shipments- and purchase-weighted basis started in the 1990s, the patterns are more apparent with the addition of the 2001-2006 data included in the current analysis.

the variation in electricity prices in 1963 and over 40% of the variation in electricity prices in 2006. Figure 5 shows both the overall and between state electricity price dispersion for 1963 to 2006. The between state dispersion increases secularly on a shipments-weighted basis but declines on a purchase-weighted basis.

There may be many factors underlying the spatial variation in electricity prices. Davis et al. (2008) found substantial variation in electricity prices across utilities and that sources of this variation include the type of fuel used to generate electric power and the ownership structure of the utility.[10] Since electricity market regulation in the U.S. is largely a state function, another possible source of spatial variation is the different regulatory regimes of states. In the next section, we explore the role played by regulatory regimes in spatial variation.

4. Regulatory Regimes and Electricity Prices

The basic facts presented in section 3 show that there is considerable spatial dispersion in the electricity prices paid by U.S. manufacturing plants. Two basic and related questions that we seek to address in this paper are: (i) what is the impact of elected vs. appointed public utility commissions on the price of electricity faced by manufacturing customers? (ii) what is the impact of the deregulation of electricity markets in selected states on the price of electricity faced by manufacturing customers?

We address these questions by estimating pooled year regressions with the dependent variable the log real price of electricity of a plant in a given year on year fixed

[10] Davis et al. (2008) classify utility ownership into three categories: public (e.g., Tennessee Valley Authority), private (investor-owned utilities), and municipal and cooperative. Of the 702 utilities in the PQEM database, 2% are public utilities, 25% are private utilities, and 73% are cooperative or municipal utilities. Cooperative and municipal utilities tend to be much smaller than public and private utilities. Despite making up 73% of the 702 utilities, only about 9% of plants in the PQEM database are served by cooperative or municipal utilities.

effects, state fixed effects (in our preferred specification), a set of controls and dummy variables capturing the regulatory regimes. For controls, we include a fifth order polynomial in the log electricity purchases of the plant as our prior work (Davis et al. (2008)) shows that prices vary considerably by purchase size, the shares of electric power generated from hydro, nuclear, coal, and petroleum and natural gas, and dummy variables about the type of ownership for the utility that serves the plant.

Many of these controls are, as shown in Davis et al. (2008), important factors in accounting for spatial variation. However, there are likely omitted factors that vary across states and generate problems of inference in terms of both reverse causality or omitted variables. To overcome these problems, our preferred specification also includes state fixed effects. In this specification, we have a difference-in-difference specification given the inclusion of state fixed effects as well as year effects. As such, the identification of the regulatory effect comes from variation across time within states. For the elected vs. appointed commission effect, the identification comes from those states that switch their method of selecting public utility commissions. For active restructuring, the identification comes from those states that change status between inactive and active restructuring. The additional controls account for other factors important for the variation in electricity prices across time and space.

In Table 4, we report results from the regression of electricity prices on these controls as well as a dummy variable indicating whether the state has an elected public utility commission and a second dummy variable indicating whether the state is undergoing active restructuring in the year in question.[11] We report results from regressions both with and without state fixed effects, and we estimate this specification using both shipments and purchase weights.[12]

In all four specifications shown in Table 4, we find that the log price of electricity is significantly lower in states with elected commissions. For example, for the shipments-weighted specification without state fixed effects, the difference is about 12 log points. The difference drops to about 4 log points when state fixed effects are included. For the purchase-weighted specification, the effect is about 9 log points without state fixed effects and about 7 log points with state fixed effects. Our result is consistent with the conclusions of Besley and Coate (2000) who find "there is evidence in favor of the idea that elected states are more pro-consumer in their regulatory policies." For our preferred specifications with state fixed effects, the impact is modest on a shipments-weighted basis but larger on a purchase-weighted basis.

We look at the coefficient on the active restructuring dummy in Table 4 to address the second question. For three of the four specifications, we find that the price of electricity is significantly higher in those state-years with active restructuring. For example, on a shipments-weighted basis without state fixed effects, the difference is greater than 4 log points. Joskow (2005) points out that states with the highest electricity

[11] On a sample-weighted basis, an average of 14% of plants per year are in states with elected public utility commissions. These plants represent an average of 16% of payroll, 18% of shipments, and 24% of electricity purchases. On a sample-weighted basis, for the years 1997-2006, an average of 38% of plants per year are in states with active restructuring. These plants represent an average of 36% of payroll, 34% of shipments, and 33% of electricity purchases in those years.

[12] We also estimate these regressions including each regulatory dummy variable individually. The results are very similar. The signs on all of the regulatory dummy coefficients are the same as they are in Table 4, and all of the coefficients are significant. The magnitudes of the elected public utility commission dummy coefficients are very similar, while the magnitudes of the active restructuring dummy coefficients are about 20% smaller on average.

prices initiated the discussion of electricity market restructuring. If states with high prices are the states with active restructuring, our restructuring dummy variable in the specification without state fixed effects could just be an indicator for states with high prices. As we noted above, to mitigate such problems, our preferred specification also includes state fixed effects. On a purchase-weighted basis, we still find that the price of electricity is higher in state-years with active restructuring though the effect is much smaller. However, on a shipments-weighted basis, we find that the price of electricity is lower in states with active restructuring. For our preferred specification, we find mixed evidence on the impact of active restructuring depending on whether we consider shipments vs. purchase weighting. To the extent that restructuring targets the price of electricity for the average unit of output, we find a modest reduction in the average price of electricity in states undertaking active restructuring.

To provide some perspective on the magnitude of the effects estimated in Table 4, it is useful to consider the overall amount of between state variation. On average, between state variation is about 28 log points on a shipments-weighted basis and about 33 log points on a purchase-weighted basis. But we know the between state variation reflects many factors. For example, we find after controlling for size effects, power source effects and ownership type effects (as in the controls in Table 4), that the between state standard deviation is around 16 log points on a shipments-weighted basis and about 17 log points on a purchase-weighted basis. Returning to the estimates of Table 4, the impact in changing from an appointed to elected public utility commission in the preferred specification reduces the price of electricity by about 4 log points on a shipments-weighted basis and 7 log points on a purchase-weighted basis. These are substantial effects relative to the between state variation (after accounting for other controls). The results are mixed and modest on active restructuring but, for example, the reduction in price on a shipments-weighted basis is 1.5 log points. While the results in this paper are preliminary, these findings suggest that the process of restructuring did not have a major impact on the spatial variation in electricity prices for industrial customers.

5. Conclusions

In this paper, we explore the role of two regulatory regimes in accounting for variation in prices across U.S. manufacturing customers. The observed dispersion in electricity prices paid by U.S. manufacturing plants is very large in absolute magnitude. This dispersion has recently exhibited a decline on a purchase-weighted basis and an increase on a shipments-weighted basis. The recent pattern of between state dispersion mimics the recent pattern of overall dispersion. That is, between state dispersion for industrial customers has increased in the period between 1990 and 2006 on a shipments-weighted basis and declined on a purchase-weighted basis.

There are undoubtedly many factors underlying the observed spatial dispersion in electricity prices. Our current and prior research suggests that an important fraction of spatial dispersion is accounted for by differences across locations in the purchase size distribution, in the fuels used to generate electricity and in the ownership structure of utilities.

Using a difference-in-difference estimation approach in order to identify the effects, we find that states with elected public utility commissions have significantly lower electricity prices for manufacturing plants on both a shipments-weighted and purchase-weighted basis than states with appointed public utility commissions. In contrast, we find mixed but modest results on the impact of active restructuring on electricity prices paid by U.S. manufacturing plants. We find that electricity prices become slightly lower in states with active restructuring on a shipments-weighted basis, but, on a purchase-weighted basis, we find that the price of electricity is slightly higher in states with active restructuring.

The effect of changing from an appointed to an elected public utility commission, 4 log points on a shipments-weighted basis, is substantial when compared to the between state variation in electricity prices after controlling for other factors that affect the spatial variation in electricity prices, 16 log points on a shipments-weighted basis. The effect of implementing retail electricity market restructuring is much smaller, 1.5 log points on a shipments-weighted basis. Our preliminary findings suggest that the process of restructuring did not have a major impact on the spatial variation in electricity prices for industrial customers.

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Table 1. Selected Characteristics of the PQEM Database

Years covered	1963, 1967, 1972-2006
Number of plant-level observations per year	48,158 to 68,186
Total number of annual plant-level observations[a]	2,136,644
Number of counties with manufacturing plants	3,040
Number of industries (SIC 1972 / SIC 1987 / NAICS 1997)[b]	447 / 458 / 473
Number of best-match utilities[c]	702
Mean annual electricity purchases, Gigawatt hours (GWh)[d]	107.6 (790.4)
Standard deviation of annual electricity purchases (GWh)[d]	332.6 (2,240.3)

Weighting Method	Quantiles of Annual Electricity Purchases, Gigawatt-hours[e]								
	1	5	10	25	50	75	90	95	99
Shipments	.08	.34	.81	3.71	18.4	96.2	285	484	1,576
Purchases	.22	1.17	3.02	14.03	84.8	439	1,858	3,768	13,750
Weighting Method	Quantiles of Electricity Costs as a Percent of Total Labor Costs[e]								
Shipments	0.4	1.1	1.5	2.6	4.8	10.8	28.4	50.8	185.7
Purchases	1.1	2.1	3.0	6.3	17.8	61.3	197.1	303.7	1,367

Notes:
[a] The initial sample contains 2,269,474 records. We drop 117 records because of invalid geography codes and 131,624 because of missing values for electricity price, total employment, value added or shipments. We also trim the bottom 0.05% of the electricity price distribution in each year (1,089 observations over all years).
[b] We use 4-digit 1972 SIC codes in 1963, 1967, and 1972-1986, 4-digit 1987 SIC codes in 1987-1996, and 6-digit 1997 NAICS codes in 1997-2006.
[c] There are 689 best-match utilities not counting public power authorities: Tennessee Valley Authority, Bonneville Power Administration, New York Power Authority, Santee Cooper, Grand River Dam Authority, and the Colorado River Commission of Nevada. By construction, a best-match utility does not cross state lines.
[d] Weighted by shipments (electricity purchases).
[e] For disclosure reasons, the quantiles shown above are averages of plant-level observations in three quantiles, the quantile shown and the two surrounding quantiles (e.g., quantile 50 as shown is the average of observations in quantiles 49, 50, and 51).

Table 2. Method of Selection for Public Utility Commissions By State, 1960-2006

Selection Method	**States**
Elect (11)	AL, AZ[1], GA, LA[2], MS[3], MT, ND, OK, SD, TN, VA[4]
Appoint (34)	AK, AR, CA, CO, CT, DC, DE, HI, ID, IL[5], IN, KS, KY, MA, MD, ME, MI, MO, NC, NE[6], NH, NJ, NV, NY, OH, OR, PA, RI, UT, VT, WA, WI, WV, WY
Switch (6)	FL[7] (E 1960-1978 / A 1979-2006) IA (A 1960-1961 / E 1962-1963 / A 1964-2006) MN (E 1960-1971 / A 1972-1975 / E 1976-1977 / A 1978-2006) NM (A 1960-1997 / E 1998-2006) SC (A 1960-1995 / E 1996-2006) TX (E 1960-1976 / A 1977-2006)

Source: Besley and Coate (2000), *The Book of the States* (1960-2007), and various public utility commission Web sites (see Table 2 notes).

Notes:

[1] In 1999, an Arizona commissioner was deemed ineligible by the courts. The Governor temporarily appointed a new commissioner. An election was held in 2000, and the appointee from 1999 was elected to continue as a commissioner. (Source: http://www.cc.state.az.us/)

[2] In Louisiana, the chairman of the commission is chosen from a board of elected commissioners. (Source: http://www.lpsc.org/)

[3] In 1990, the Public Utility Staff was formed in Mississippi. They are appointed. However, they serve in an advisory capacity to the Public Service Commission, which is still elected. (Source: http://www.psc.state.ms.us/)

[4] In Virginia, the public utility commission is elected by the state legislature.

[5] The 2000 volume of *The Book of the States* shows that the public utility commission was elected. However, the Illinois Commerce Commission Web site (http://www.icc.illinois.gov/) shows that all commissioners have been appointed by the Governor.

[6] This differs from Besley and Coate (2000). Nebraska is served entirely by publicly-owned utilities (including municipals and cooperatives). The Nebraska Power Review Board was formed in 1963 and is appointed by the Governor and confirmed by the legislature. (Source: http://www.nprb.state.ne.us/)

[7] This differs from Besley and Coate (2000). In 1978, the state legislature in Florida changed the Commission from a three-member elected board to a five-member appointed board. (Source: http://www.psc.state.fl.us)

Table 3. States with Retail Electricity Market Restructuring Legislation

State	Legislation Year	Restructuring Year (Commercial and Industrial)	Notes
AZ	1998	1998	Court decision to end retail competition in March 2004
AR	2001		Repealed
CA	1996	1998	Suspended in September 2001
CT	1998	2000	
DE	1999	1999	
DC	2000	2001	
IL	1997	1999	
MA	1997	1998	
MD	1999	2000	
ME	1997	2000	
MI	2000	2002	
MT	1997		Repealed
NH	1996	1998	Phased in between 1998 and 2001
NJ	1999	1999	
NM	1999		Repealed
NV	1997	2002	
NY	1996	1998	Phased in between 1998 and 2001
OH	1999	2001	Cooperatives not required to deregulate
OK	1997		Delayed Indefinitely
OR	1999	2002	
PA	1996	1999	Phased in through 2001
RI	1996	1997	
TX	1999	1997	
VA	1999	2001	Repealed effective July 2007[1]
WV	1998		Authorized, but never implemented

Source: EIA (2003).
Note:
[1] Virginia (VA) re-established retail rate regulation as of July 2007. However, customers purchasing more than 5 megawatts annually still have the option to choose their electricity supplier. (Source: http://www.scc.virginia.gov)

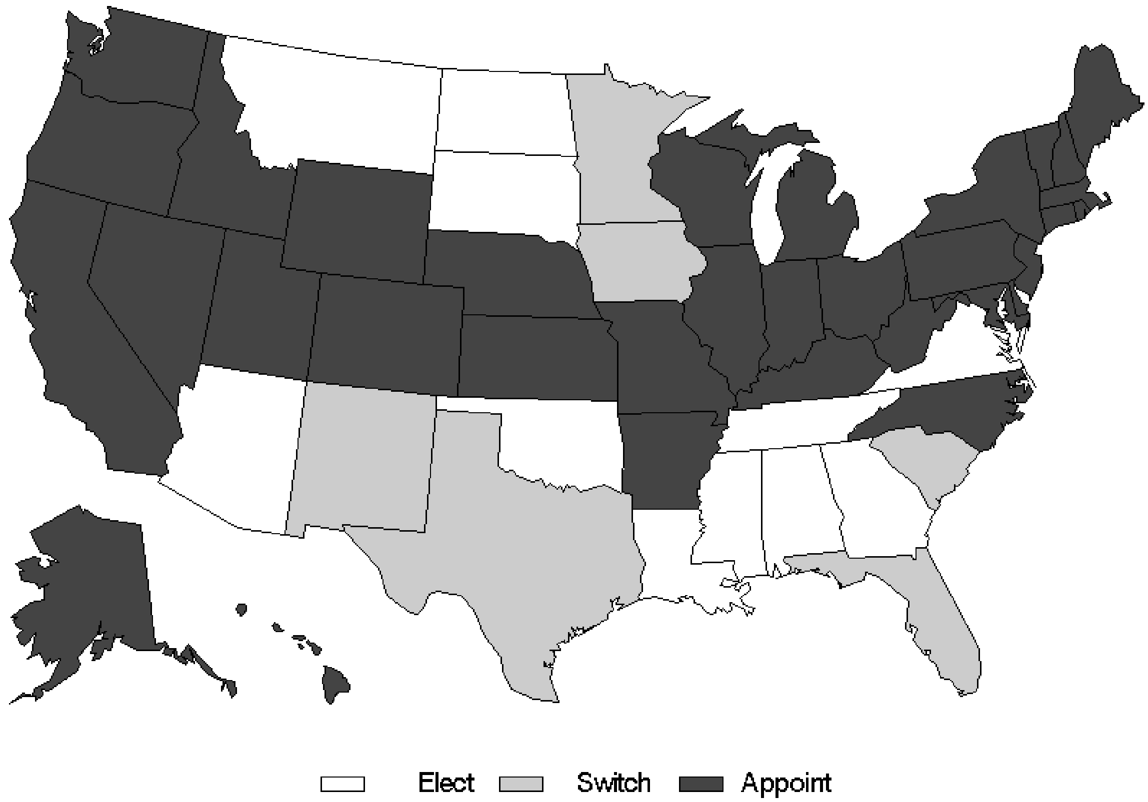
Table 4. Effect of Method of Public Utility Commission Selection and Electricity Market Restructuring, Pooled Years

Dependent Variable: Log Real Price of Electricity

	Shipments-Weighted		Purchase-Weighted	
	(1)	**(2)**	**(3)**	**(4)**
Elected Public Utility Commission	-0.122	-0.036	-0.089	-0.069
	(0.001)	(0.002)	(0.001)	(0.002)
Active Restructuring	0.044	-0.015	0.056	0.029
	(0.001)	(0.001)	(0.001)	(0.001)
State Fixed Effects	no	yes	no	yes
Adjusted R-square	0.989	0.991	0.990	0.991
N	2,136,644	2,136,644	2,136,644	2,136,644

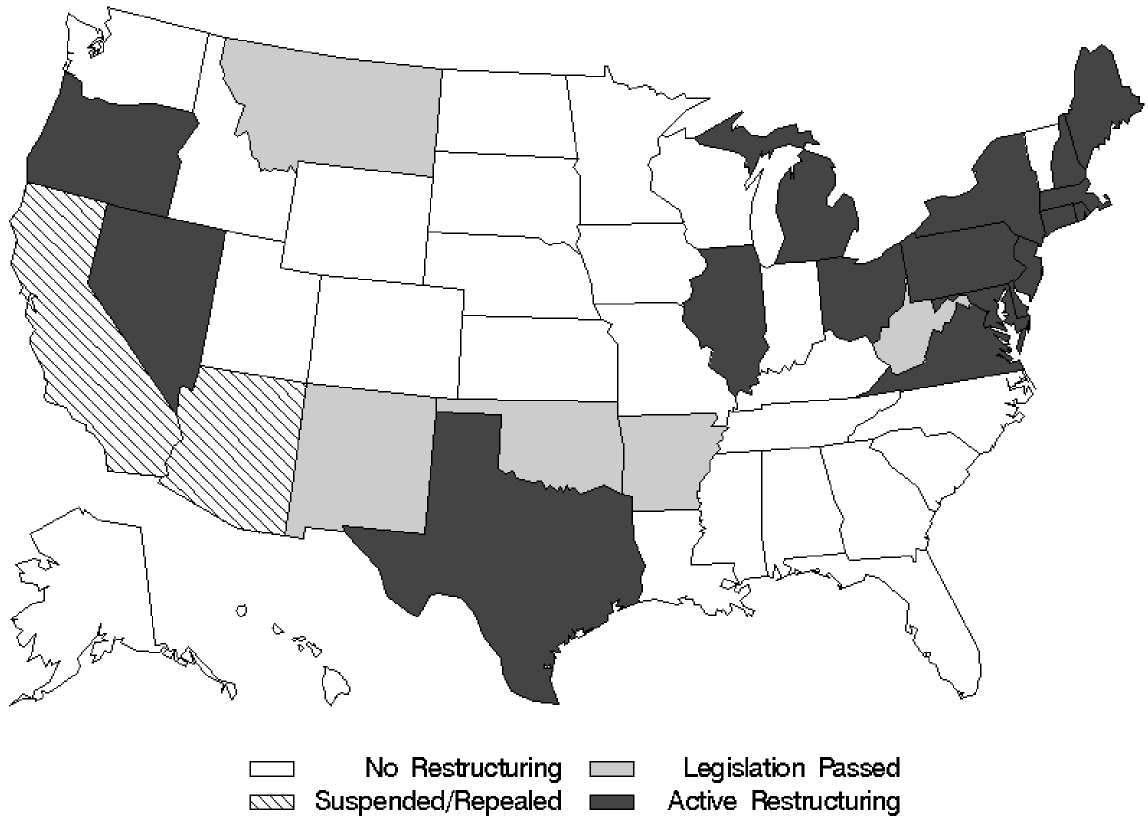
Source: Authors' calculations on the PQEM database.

Notes: Results are for pooled years, 1963, 1967, and 1972-2006. The elected public utility commission variable is a dummy variable equal to one if the state public utility commission is elected. The active restructuring variable is a dummy variable equal to one if electricity restructuring is active in the state for commercial and industrial customers. Year fixed effects and additional controls, described below, are included in the regression, but detailed results are not shown. Dummy variables for public and private utility ownership variable are included, and the omitted category is cooperative and municipal ownership. State shares by year of electric power generated from hydro, nuclear, and petroleum and natural gas are also included. Shares of both coal and "other" (includes geothermal, wind, wood and waste, photovoltaic, and solar) are omitted since "other" is always very small. Finally, to control for the effect of quantity discounts, a fifth-order polynomial in log electricity purchases is included as a control.



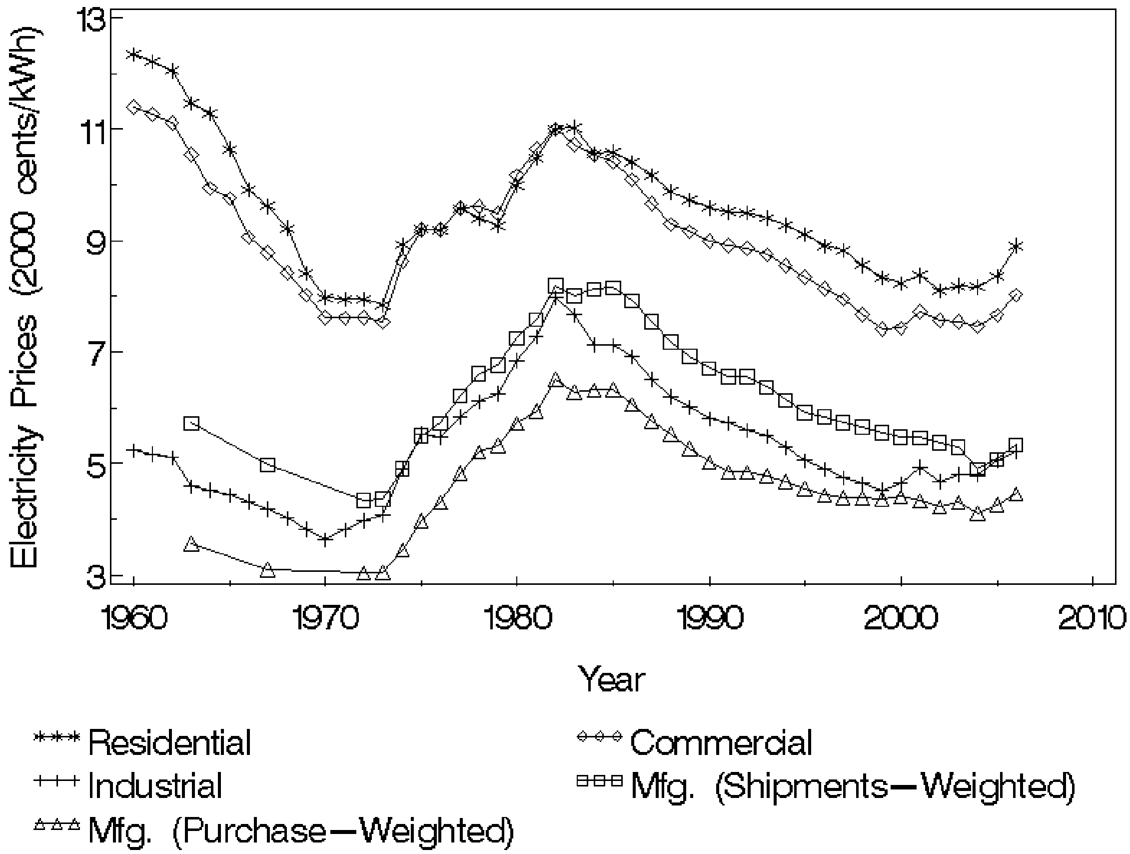
Source: Besley and Coate (2000), *The Book of the States* (1960-2007), and various public utility commission Web sites (see Table 2 notes).

Figure 1. Selection Method of Public Utility Commissions, 1960-2006



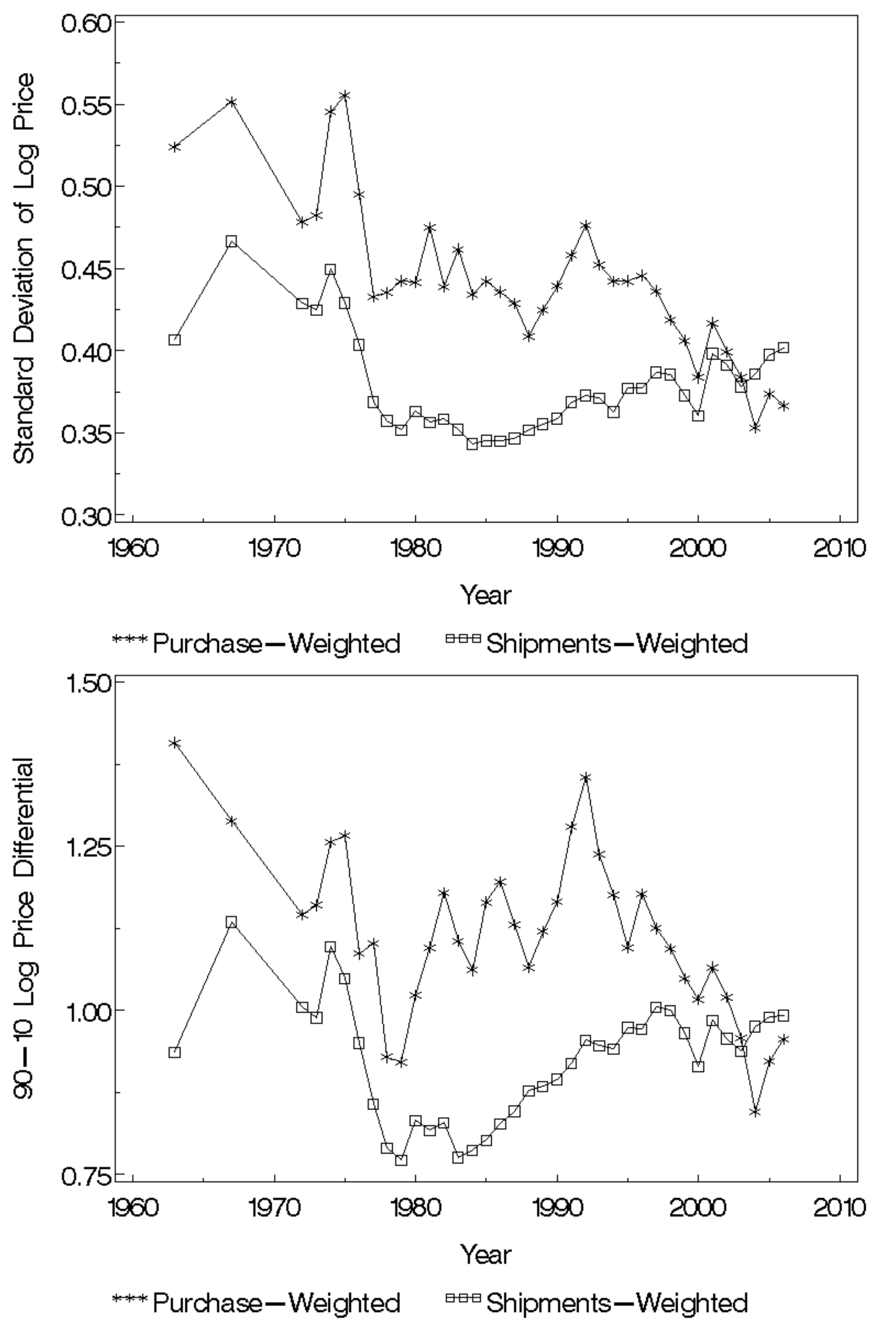
Source: EIA (2003).

Figure 2. State Retail Electricity Market Restructuring Status as of 2006



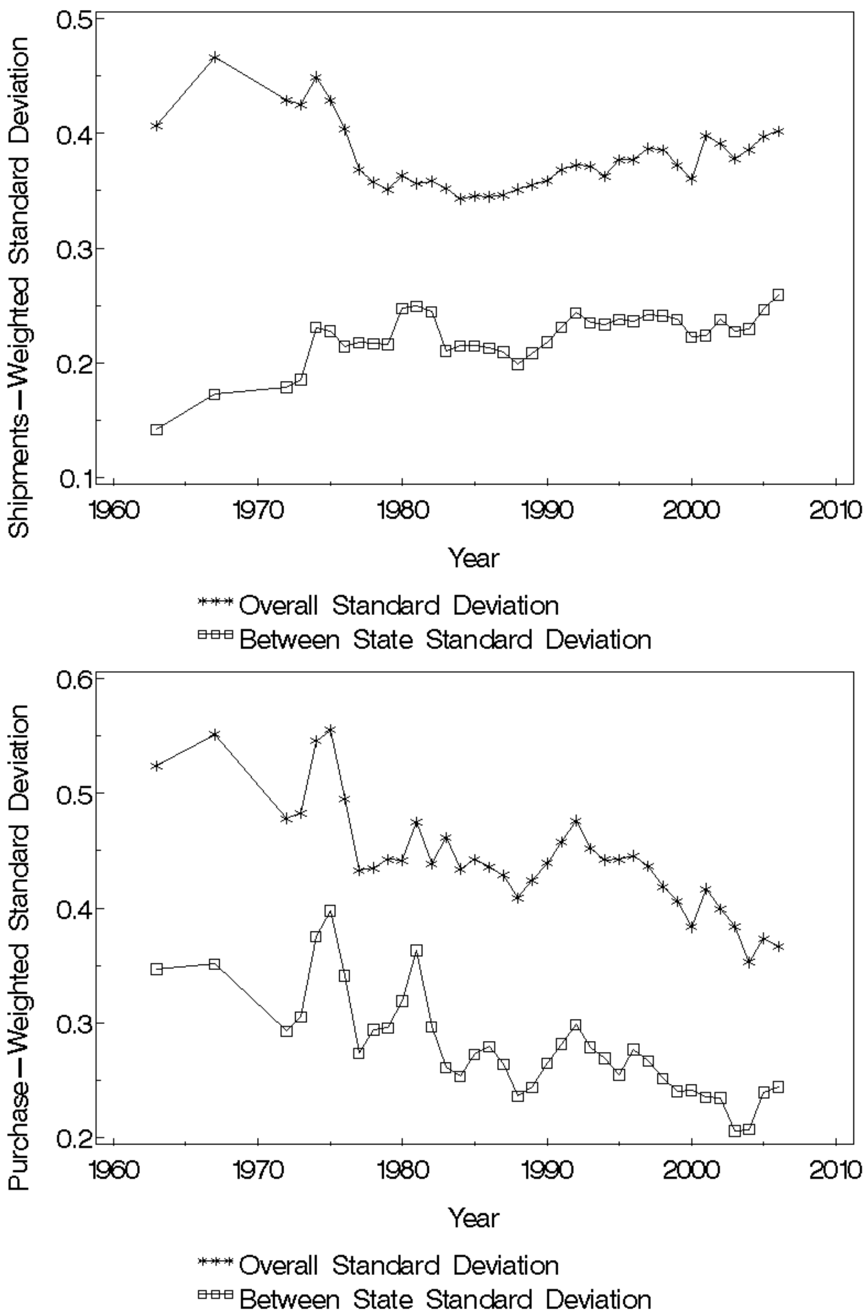
Source: Energy Information Administration for Residential, Commercial and Industrial series; authors' calculations on PQEM data for Manufacturing.

Figure 3. Real Electricity Prices by End-Use Sector, 1960-2006



Source: Authors' calculations on PQEM data.

Figure 4. Electricity Price Dispersion Among U.S. Manufacturing Plants, 1963-2006



Source: Authors' calculations on PQEM data.

Figure 5. Overall and Between State Electricity Price Dispersion, 1963-2006