Does Private Ownership Reduce Political Distortions? Evidence from U.S. Electric Utilities

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Politics is believed to distort decisions in regulated private firms as well as in government enterprises. In order to compare the magnitude of these distortions, I examine one of the very few large U.S. industries where both for-profit and government enterprises sell goods to the public: electric utilities. I follow the existing literature in measuring political distortions in two ways: differences between government decisions in election years versus in non-election years, and governments' inability to quickly adapt to change. Using comprehensive U.S. data for the years 1964 through 2014, I find that for-profit electricity rates are more likely to be manipulated before elections, but are more responsive to costs, compared to government electricity rates. Thus private ownership need not reduce political distortions, and may actually increase them. I further provide a theoretical framework that explains the findings.

Private firms are believed to suffer from fewer political distortions than government owned enterprises [Peltzman, 1971, La Porta and Lopez-de-Silanes, 1999]. While the regulation of private firms may be subject to politics, it is believed that the magnitude of the accompanying political distortions is limited by takings law, regulatory law, and outsourcing contracts [Lopez-de-Silanes et al., 1997], public discomfort with subsidizing private firms [Boycko et al., 1996], and the political influence of private firms [Bennedsen, 2000].

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The belief that private ownership reduces political distortions is difficult to verify empirically since private and government firms differ in many dimensions; for instance, they differ in the weight they put on social objectives and on whether they have a residual claimant with incentives to monitor managers. Thus empirical evidence that private firms make higher profits, or use less labor, does not establish conclusively that these firms suffer from less political interference.

Empirical determination of whether private ownership reduces political distortions, necessitates a measure of political distortions which can be observed for a large number of government owned and privately owned firms that operate concurrently. In the United States, electric power transmission and distribution is one of the very few large industries where both for-profit (investor-owned) and government enterprises (municipal) sell goods to the public. Thus, electric utilities are an ideal sample to determine whether political distortions vary by ownership type.

We use two common measures of political distortions. The first is charging lower electricity prices before elections and has been examined by Moita and Paiva [2013] and Englmaier et al. [2017]. More generally, a large literature has studied how the supply of public goods rises and taxes decrease right before elections [Rogoff, 1990, Boylan and McKelvey, 1995, Levitt, 1997, Akhmedov and Zhuravskaya, 2004, Brender and Drazen, 2005, Shi and Svensson, 2006, Foremny and Riedel, 2014, Vlaicu and Whalley, 2016].

The second measure of political distortions is the unresponsiveness of electricity prices to costs, and has been examined by Peltzman [1971] and Joskow [1974].[1] More generally, a frequently discussed political distortion is the inability of governments to quickly respond to change [Alesina and Drazen, 1991, Kaufman, 2001, Diller, 2007].

These two political distortions are socially costly, since they raise the deadweight losses from the markups necessary to cover fixed costs and profits.[2] Further, because they have been so frequently studied, there is empirical evidence that they are correlated with other more costly (but more difficult to observe) distortions. Shi and Svensson [2006] show that countries with higher election-year deficits tend to be more corrupt, Akhmedov and Zhuravskaya [2004] find that Russian regions

[1]Peltzman [1971] examines unresponsiveness of electricity prices to differences in group-specific costs, while Joskow [1974] examines the unresponsiveness of electricity prices to decreases in costs.

[2]Since the deadweight loss is quadratic in markup, the deadweight loss of a variable markup is greater than the deadweight loss of a constant markup which generates the same level of revenues, see Appendix A.

with greater election-year social and total spending tend to have less transparent governments, while La Porta et al. [1999] find that countries with more bureaucratic delays tend to be more corrupt.[3]

Using data for U.S. electric utilities for the years 1990 through 2014, I find that investor-owned utilities manipulate electricity prices around elections more than municipal utilities. (In other words, gubernatorial elections have a larger effect on investor-owned utilities than gubernatorial or mayoral elections have on municipal utilities.) However, I find that investor-owned utilities respond to changes in input costs faster than municipal utilities. Data for the years 1964–1979 corroborates these findings. The advantage of the older data is that it provides electricity rates by city and consumption level, rather than average prices over all cities served by a utility and over all customers' consumption levels.

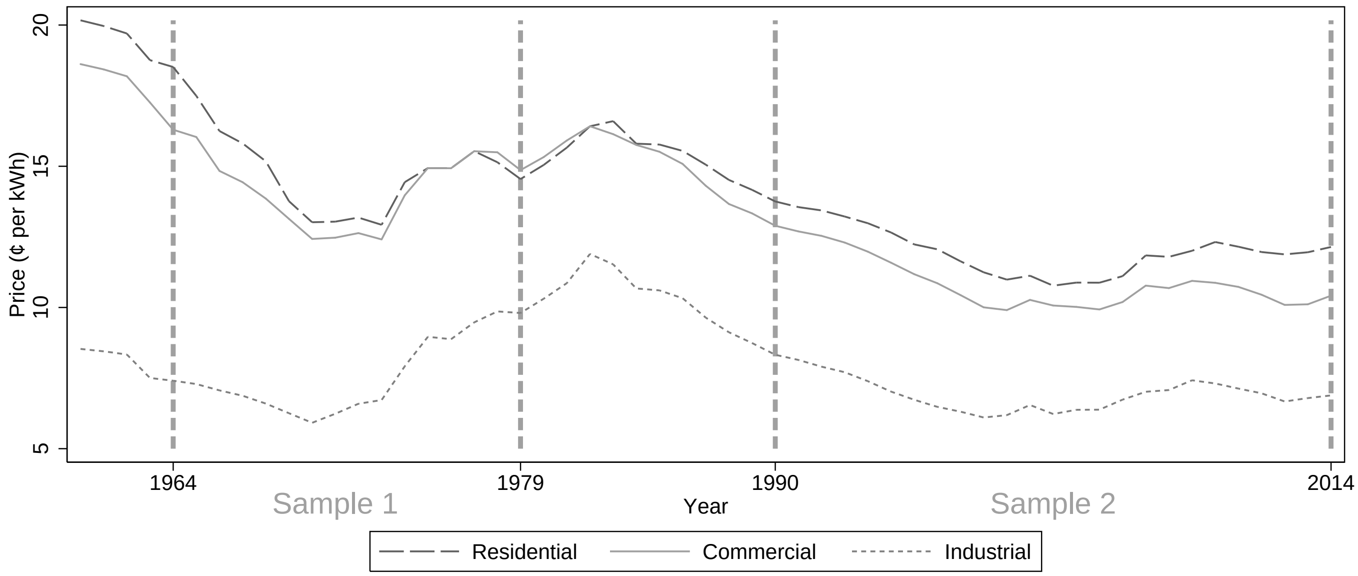
The result that investor-owned utilities manipulate electricity prices more than municipal utilities contradicts the belief that private firms suffer from fewer political distortions than government owned enterprises. While the magnitude of the result tends to be small, it holds for comprehensive U.S. data, different measures of prices (average vs. marginal), different estimation procedures (fixed-effects vs. first differences), and over periods of slowly changing electricity prices and periods of rapidly changing electricity prices, see Figure 1.

The empirical findings are not easily reconciled with existing explanations for the role of ownership type on political distortions. Specifically, if regulatory law limits government ability to influence investor-owned utilities or if governments find it easier to subsidize government owned firms, pre-election manipulations should be more common with municipal utilities than with investor-owned utilities.

In contrast, the empirical findings can be explained by the fact that, in the United States, private ownership of electric utilities centralizes government authority, and that political centralization can increase political distortions. Specifically, existing theoretical findings indicate that centralization can lead to lower electricity prices before elections. To the best of my knowledge, the potential benefits of public ownership that derive from the decentralization of political author-

[3]Shi and Svensson [2006] argue that in corrupt countries elected offices are more valuable and hence elected officials are more willing to manipulate budgets to remain in office.

Figure 1: Real electricity prices over two sample periods



Electricity prices in ¢ per kWh (2012 dollars). *Source*: U.S. Energy Information Administration, Annual Energy Review, September 2012, Average Retail Prices of Electricity, 1960-2011 and U.S. Energy Information Administration, Electric Power Monthly, October 2017, Average Price of Electricity to Ultimate Customers: Total by End-Use Sector, 2007-October 2017.

ity have not been discussed before. For this reason, I develop a theoretical framework that links ownership type, centralization of political authority, and political distortions.

These empirical and theoretical findings, that political distortions can be lessened by municipal ownership, are relevant to the current debate over whether states should regulate municipal broadband. Currently, 19 states ban or restrict municipal broadband service [Raja, 2014]. Proponents of the ban argue that municipal ownership exposes local taxpayers to risky government ventures, while foes argue that municipalities understand local needs better. Studying the effects of municipal ownership of electric utilities should provide some insights regarding the cost and benefits of municipal broadband. Specifically, most states exempt municipal electric utilities from state supervision, and municipal ownership does not appear to have affected local taxpayers negatively. On the contrary, Strauss and Wertz [1976] and Stumm and Khan [1996] find that cities with municipal electric utilities collect lower property taxes (on a per capita basis). Nonetheless, detractors of municipal electric utilities exemption from state regulation have argued that state proceedings are less susceptible to political manipulation than local decision making, and thus the same arguments could be made for broadband [Meyer, 1983]. However, my study findings suggest that this concern may be unwarranted.

My results provide further evidence that pre-election manipulations proxy for more serious political pathologies, such as corruption and lack of transparency [Akhmedov and Zhuravskaya, 2004, Shi and Svensson, 2006]. Specifically, I show that the manipulation of electricity prices around gubernatorial elections is more likely to occur in the most corrupt States. The corruption measure is obtained from a 1999 survey of newspaper reporters with offices in State Houses [Boylan and Long, 2003], a measure widely used by academics (e.g., Hochberg and Rauh [2013], Saiz and Simonsohn [2013], and Smith [2016]).

These results also contribute to the literature on price rigidities. Existing work suggests a number of reasons for why prices adjust slowly to cost, including menu costs, long-term relations with buyers, search costs, and production stickiness [Borenstein and Shepard, 2002]. Further, it is well known that competition reduces price rigidities [Hannan and Berger, 1991, Borenstein and Shepard, 2002, Bils and Klenow, 2004]. However, I am not aware of any prior work that has shown the role of ownership type on the speed of price adjustments.

A few empirical studies have provided estimates of political distortions in electric utilities. These studies have shown that: electricity prices charged by Brazilian private utilities [Moita and Paiva, 2013] and German municipal utilities [Englmaier et al., 2017] are lower before elections; regulated investor-owned utilities are more likely to change electricity rates following increases in input costs than decreases [Joskow, 1974]; and the uncertainty regarding the political affiliation of future regulators leads to insufficient investments in the United States' investor-owned electric distribution networks [Lim and Yurukoglu, forthcoming]. However, I am not aware of any prior empirical studies that compare political distortions in regulated private firms with political distortions in government enterprises.[4]

[4] Englmaier et al. [2017] compare residential prices of private and municipal utilities around municipal elections. However, they examine a time period when private utilities in Germany were unregulated and thus free from political interference. In contrast, in the United States, very few residential customers purchase electricity from unregulated firms [Joskow, 2006]. Further, as discussed in the theoretical framework, municipal ownership reduces political distortions when individuals sort themselves into homogenous municipalities. However, one expects German cities to be less homogenous because they provide smaller benefits for living in affluent municipalities, compared to American cities. German States are responsible for K-12 education and redistribute funds to ensure that poorer municipalities can finance their needs, thus reducing the benefits of living in more affluent municipalities.

Peltzman [1971] and Kwoka [2002] provide empirical evidence that municipal utilities practice less price discrimination than investor-owned utilities. This provides evidence of political distortions with public ownership only

The paper discusses, in turn, the theoretical framework, empirical framework, data, and empirical findings.

1 Theoretical framework

In this section, I provide a theoretical explanation for the empirical findings. Namely, that private ownership in electric utilities leads to higher political distortions, as measured by lower electricity prices before elections, and by electricity prices that respond more slowly to changes in input costs. Specifically, I argue that private ownership centralizes political authority over U.S. electric utilities, and that the centralization of political authority increases political distortions.

Unlike other countries, government owned electric utilities in the United States tend to be locally owned and select rates without central government interference. In contrast, investor-owned utilities' rates are regulated by the States, since regulating electric utilities is too costly for most local governments. Electric utility regulation is expensive, because governments have to pre-commit to prices and rules through a quasi-judicial process, in order to ensure that private businesses make large investments.[5] Regulation costs are further increased by frequent court reviews of agencies' procedures [Rose-Ackerman and Rossi, 2000]. In response to court decisions, regulatory commissions publish notice of proposed rate changes, hold hearings on the reasonableness of proposed rates, and formulate methodologies for revenue requirements and cost of service, for different customer classes [Krieger, 1995].[6] Thus, regulation is expensive, and most local governments are too small to afford it.[7] Thus, in the United States, private ownership of electric utilities leads to greater centralization of political authority.

Greater centralization of political authority leads to officials elected by more heterogenous and

under the assumptions that investor-owned utilities select profit maximizing prices and if we assume that investor owned and municipal utilities serve similar types of customers.

[5]Knittel [2006] provides empirical evidence that this quasi-judical process seeks to ensure that private investors profit from their large investments. Specifically, he finds that state regulations were first adopted in states with large capacity shortages, presumably caused by private investor's fears of not being able to profit from large investments.

[6]Insurance is another industry that is costly to regulate. Grace and Phillips [2007] provide evidence that it is more costly for smaller states to provide insurance regulation, compared to larger states.

[7]Originally, cities regulated investor-owned utilities by specifying, in the franchise contract, prices and the way that prices could be adjusted. However, the size of private investments would lead to 20 to 50 year contracts, thus making it difficult to specify how the prices would adjust over the contract period [Priest, 1993].

less informed populations. Specifically, compared to states, individuals are more likely to sort themselves into cities with individuals that share similar preferences for local public goods, share preferences for neighbors (e.g., their race and ethnicity), or have similar employment [Tiebout, 1956, Rhode and Strumpf, 2003]. Further, voters are also more likely to have personal interactions with city officials and to be informed about their abilities and preferences, compared to state officials.

A number of theoretical models have shown that government officials may personally benefit by increasing the supply of public goods and decrease taxes before elections, even though this leads to welfare losses. These models hinge on the assumption that individuals' preferences are heterogeneous or that or individuals are uninformed about elected officials abilities and preferences [Rogoff, 1990, Boylan and McKelvey, 1995, Vlaicu and Whalley, 2016]. In the context of electricity pricing, decreasing taxes corresponds to lowering electricity prices. Thus, the political pathologies caused by centralization can explain why investor-owned utilities are more likely to delay increases in electricity prices until after elections, compared to municipally owned utilities. Further, the three factors that lead to different policies in election years are likely to be strongly correlated with one another: namely, in jurisdictions where voter preferences are homogenous, we expect voters to have more information about their government officials' abilities and preferences. For this reason, we do not provide any empirical evidence in favor of one model over the other. However, to make this discussion more concrete, we provide below a simple model for how heterogeneity of voter preferences can lead to lower electricity before elections.

Political centralization has other negative consequences. Lockwood [2002] and Besley and Coate [2003] show that centralization makes it more likely that elected officials select policies that benefit a slim majority but impose large costs on the rest. Hindriks and Lockwood [2009] show that with centralization, ineffective elected officials can appear more competent by providing more services to a majority of voters, who do not realize that these additional services are being financed by diverting resources from voters in other regions. Thus, private ownership of electric utilities can increase political distortions in a number of ways.

In the remainder of this section I construct a simple model in which political centralization leads to lower electricity prices before elections. Specifically, the model assumes that centralization makes individuals' preferences more heterogeneous, and show that this heterogeneity leads to lower electricity prices in election years. In the model, individuals agree on electricity prices for three years: periods 1, 2, and 3. Thus, period three is the last year of the agreement and is interpreted as the election year. Individuals are identical except for their time preference. Under centralized government, decisions are made by a majority of voters who differ in time preferences. Thus, any coalition that defeats the individual with median time preferences must include both individuals that are more patient and less patient than the median time preference individual. The price path preferred by such a coalition must consist of low prices in period 1 (to appeal to the impatient individual), low prices in period 3 (to appeal to the patient individual), and thus high prices in period 2 (to satisfy the budget constraint). Consequently, electricity prices decrease in election years when prices are selected by a coalition of patient and inpatient individuals. Further, we show that this coalition occurs often enough for the average price to decrease in election years (where the average is computed across possible coalitions).

In contrast, with decentralized government, I assume that each jurisdiction consists of individuals with identical time preferences. Price in each jurisdiction increases or decreases in election years, depending on the jurisdiction's time preference. However, we show that for a numerical example, the average price selected over all jurisdictions increases before an election.

Formally, in the model there are three individuals $i = 1, 2, 3$ and three time periods $t = 1, 2, 3$. Each individual has an income of three which must all be spent on electricity. Individuals differ only in the discount factor δ_i, which is equal to 0.5, 1, and 1.5 for individuals 1, 2, and 3. Electricity prices in period t is p_t, while individual i's electricity consumption is c_t^i. Overall utility of individual i is

$$\ln(c_1^i) + \delta_i \ln(c_2^i) + \delta_i^2 \ln(c_3^i),$$

where

$$p_1 c_1^i + p_2 c_2^i + p_3 c_3^i = 3.$$

Different electricity prices are selected under political decentralization and political centralization. Under political decentralization each individual i selects their own electricity prices subject to the feasibility constraint $c_1^i + c_2^i + c_3^i = 3$. Specifically, each individual decides the prices they face in each of the three periods. It is straightforward to show that individual i picks prices equal to $p_t^i = (1/3)(1 + \delta^i + \delta_i^2)/\delta_i^{t-1}$. Consequently, the average prices faced by the voters are $(0.722, 0.852, 1.12)$. The fact that the average electricity price is increasing before an election can be shown more generally.[8]

Under political centralization, all three individuals face the same electricity prices. An individual is randomly selected to propose electricity prices subject to the feasibility constraint $\sum_{i=1}^{3} c_1^i + c_2^i + c_3^i = 9$. If a majority accepts this proposal, these prices are implemented. If it is rejected, then the median individual (2) selects the price. In equilibrium, prices are $(1.069, 1.024, 0.911)$, $(1.115, 0.935, 0.95)$, or $(1.08, 1.023, 0.901)$ depending on whether the initial proposer is 1, 2, or 3. Thus, on average, prices are equal to $(1.087, 0.994, 0.921)$, and prices decrease in an election year.

2 Empirical framework

There are several ways that a state legislators and governors can affect investor-owned utility prices. For instance, by passing legislation instituting retail competition, suspending restructuring, allowing regulated utilities to recover costs due to a transition to a more competitive environment, requiring that a certain percentage of the state electricity be derived from renewable resources, or allowing unregulated power plants. Regulatory commissions also affect prices by choosing how to implement these legislations and in particular how to decided in electricity rate-cases. Similarly, there are several ways that mayor and city councils can affect municipal electricity prices. For instance, by ordering changes in prices or by pressuring members of the city's public utility commission to do so. Rather than looking at each of these decisions in isolation, I examine the cumulative impact of these decisions on prices of investor-owned and municipal utilities.

With the first sample, where the unit of observation is a utility u, in state s, and year t, "IOU$_u$"

[8] Suppose $\delta_1 < \delta_2 < \delta_3$ and $(1/3)\sum_i \delta_i = 1$. Note that p_t^i is decreasing in i. Hence $\frac{d}{dt}(1/3)\sum_i p_t^i = -(1/3)\sum_i p_t^i \ln(\delta_i) \geq 0$ if $-(1/3)\sum_i \ln(\delta_i) \geq 0$. However, by Jensen's inequality, $-(1/3)\sum_i \ln(\delta_i) > \ln((1/3)\sum \delta_i) = 0$. Hence, $\frac{d}{dt}(1/3)\sum_i p_t^i > 0$ and price are increasing before an election.

and "Muni_u" are indicator variables for whether the electric utility is investor or municipally owned; "Governor election_{st}" and "Mayor election_{ut}" are indicator variables for whether there is a gubernatorial election in state s and a mayoral election in the municipality that owns utility u.

I estimate the impact of elections on average electricity prices by regressing average electricity prices on indicator variables for elections and cost controls:

$$\begin{aligned}\ln \text{Average price}_{ust} = {} & \alpha_{1t} + \alpha_{2us} + \alpha_3 \times \text{IOU}_u \times \text{Governor election}_{st} + \alpha_4 \times \text{IOU}_u \times \text{Governor election}_{st+1} \\ & + \alpha_5 \times \text{Mayor election}_{ut} + \alpha_6 \times \text{Mayor election}_{ut+1} \\ & + \alpha_7 \times \ln \text{Energy input cost}_{st} + \alpha_8 \times \ln \%\text{Energy generated from fossils}_{st} + \epsilon_{ust}.\end{aligned}$$

The coefficients α_3 and α_4 are negative if investor-owned utility rates are lower before gubernatorial elections, while α_5 and α_6 are negative if municipal utilities' rates are lower before mayoral elections. Electricity generated from fossils requires higher energy input costs but lower capital costs (compared to hydroelectric and nuclear). Thus, the theory of public utility pricing implies that the price of electricity is increasing in energy input costs and is decreasing in the fraction of energy generated from fossil (i.e., $\alpha_7 > 0$ and $\alpha_8 < 0$). Note that the regression does not include a separate constant term for the utility's ownership type, since it is accounted for by the utility fixed effect (α_{2us}).

The second regression uses multinomial logit to estimate the impact of changes in electricity costs on the probability that a utility increases, decreases, or keeps electricity rates unchanged: P^{Hike}, P^{Cut}, and P^{NC}. Specifically,

$$P^{\text{Hike}}_{ust}/P^{\text{NC}}_{ust} = \exp\Big(x_{ust}\beta^{\text{Hike}} + \epsilon^{\text{Hike}}_{ust}\Big), \quad P^{\text{Cut}}_{ust}/P^{\text{NC}}_{ust} = \exp\Big(x_{ust}\beta^{\text{Cut}} + \epsilon^{\text{Cut}}_{ust}\Big),$$

where for $i \in \{\text{Hike}, \text{Cut}\}$,

$$x_{ust}\beta^i = \beta^i_{0t} + \beta_{1n_{ust}} + \beta^i_2 \times \text{Muni}_u + \sum_{j=1}^{n_{ust}} \beta^i_{3j} + \beta^i_4 \times \Delta(\%\,\text{Energy input cost}_{ust})$$
$$+ \beta^i_5 \times \text{Muni}_u \times \Delta(\%\,\text{Energy input cost}_{ust}) + \beta^i_6 \times \Delta(\%\,\text{Energy generated from fossils}_{ust})$$
$$+ \beta^i_7 \times \text{Muni}_u \times \Delta(\%\,\text{Energy generated from fossils}_{ust}),$$

$\Delta(\%\,\text{Energy input cost}_{ust})$ and $\Delta(\%\,\text{Energy generated from fossils}_{ust})$ are the changes in energy input costs and the fraction of electricity generated from fossils since the utility last changed rates, while n_{ust} is number of years since the last change in electricity rates. Note that an ordered logit model cannot be used since there is vast empirical evidence that firms decide to raise and cut prices differently (i.e, $\beta^{\text{Hike}} \neq \beta^{\text{Cut}}$).

In the second sample, the unit of observation is a utility u, in city c, state s, year t, and period p (summer, winter, or entire year).[9] Thus, in the first regression, "Price" is the average or marginal price for various consumption levels and the regression includes city fixed-effects and an indicator variable for ownership-type, rather than utility fixed-effects. In the second regression a price hike (or cut) refers to a change in the lowest prices charged by a utility in particular city and for a particular quantity.

3 Data

I examine two samples. The first sample contains average electricity prices for 339 investor-owned and 691 municipal utilities, during the years 1990 through 2014.[10] These prices are computed using data from the U.S. Energy Information Administration, Annual Electric Power Industry Report (EIA-861).[11] Energy input costs are primary energy total expenditures in the electric power sector divided by total electricity generated in a state-year, the first obtained from U.S.

[9]Some utilities have different rates for summer and winter, while others do not.

[10]In the first sample, we only include municipal utilities that have mayoral elections, and for which we have information on the dates of the mayoral election. In the second sample, we include all municipal utilities.

[11]With deregulation, distribution and sale of electricity can be provided by different firms. The data only includes sales by the company that distributes electricity.

Energy Information Administration, State Energy Data System (SEDS), while the latter obtained from U.S. Energy Information Administration, State Historical Tables, Net Generation by State by Type of Producer by Energy Source.

The second sample contains average residential bills for 236 investor-owned and 1,029 municipal utilities, for 7,561 U.S. cities, during the years 1964–1979. For the years 1964–1979, the Federal Power Commission reports the bill for monthly consumption levels of 100, 250, 750 and 1000 kilowatt hours and a particular period (summer, winter, or entire year).[12] For utilities that offer multiple rate schedules, the bill corresponds to the one applicable to the majority of consumers in each consumer group [Peltzman, 1971]. We compute marginal price as the charge for one kWh at or above each consumption level, but below the next consumption level. For instance, the marginal price at 100kWh is the difference in the bill for 250kWh and 100kWh, divided by 250 minus 100. Energy input cost are fossil fuel expenditures per net kWh generated, multiplied by the fraction of electricity generated from fossil fuels, both obtained from Cintron [1995], and both measured at the state-year level.

Each sample is complemented with political and regulatory variables. Gubernatorial election dates are from the Congressional Quarterly, Voting and Elections Collection. Mayoral election dates are obtained from Ferreira and Gyourko [2009], Newsbank, Factiva, Google News Archive, city council minutes, county electoral boards web sites, `www.ourcampaigns.com`. The method of selection for public utility commissions is from Davis et al. [2008] and Janice Beecher's "All Commissioners Data" (Institute of Public Utilities Policy Research and Education at Michigan State University).

Summary statistics are provided in Table 1, with prices and costs measured in 2012 dollars per kWh. For the first sample (top panel), average price is 10¢, and in 22% of observations the average *nominal* residential price is at least 0.1¢ lower than the previous year, while in 53% it is at least 0.1¢ higher. Average energy input cost is 2¢, and 75% of electricity is generated from fossils. Investor-owned utilities in states with appointed regulators comprise 22% of the sample, while investor-owned utilities in states with popularly elected regulators 3%. Municipal utilities

[12] Federal Power Commission, Typical Electric Bills, Typical Net Monthly Bills for Residential, Commercial & Industrial Services, various year. For earlier and later years, this publication proves bills for different consumption levels.

comprise of 75% of the sample, while 43% of observations are for municipal utilities with four-plus-year mayoral terms.

For the second sample (bottom panel), the average price is 25¢ when purchasing 100kWh per month, 13¢ when purchasing 1,000 kWh per month, in 22% of observations, the *nominal* residential price decreased over the previous year, while in 54% it increased. Average energy input cost are 3¢ and 82% of energy is generated from fossils. Further, 82% of observations are from investor-owned utilities, a much larger proportion than in the first sample since an average investor-owned utilities covers more cities than the average municipal utility.

4 Results

I first examine whether elections have a different impact on electricity prices for investor-owned than for municipal utilities. Then, I examine whether there are ownership type differences in how quickly electricity prices respond to changes in input costs.

4.1 Impact of elections on electricity prices

Table 2 includes the results of regressing 1990–2014 average electricity prices on whether there is an election this current year or the next year, as well as production costs, utility-state, city, and year fixed effects.[13] Production costs consist of energy input costs and capital costs, as proxied by the percent of electricity generated from fossils (vs. hydroelectric and nuclear): thus the higher this percentage, the lower the capital expenditures. All the costs variables are state averages, thus any differences in costs across utilities in a state are accounted by utility-state fixed effects. Since utilities do not change ownership type, the regressions do not control for whether the utility is investor-owned (IOU) or municipally owned (Muni), but only for the interaction between ownership type and elections.

For investor-owned utility, "election" refers to gubernatorial election, while for municipal utilities it refers to mayoral election. The coefficient estimates imply that in gubernatorial election years, investor-owned electricity prices are 0.7% lower, see Regression (1), coefficient for "IOU ×

[13] Errors are clustered at the state level.

(Governor election).” Since the regression includes year fixed effects, that may mean that these utilities do not increase prices, while other utilities raises them by 1%. In contrast, municipal utilities charge 0.5% less for electricity in mayoral election years. Regression (2) includes a term to measure the impact of gubernatorial elections on municipal electricity prices. Municipal utilities do not lower electricity prices in gubernatorial election years; this is not surprising since state regulators do not control the price charged by municipal utilities.[14]

Electricity prices can be impacted by legislative and by regulatory decisions, and both could be affected by elections. However, since governors appoint members of regulatory commissions, appointed commissioners are more likely to be affected by gubernatorial elections. For this reason, Regression (3) includes the following explanatory variables: the interaction of the fraction for the commission that is appointed with whether the utility is investor-owned and whether there is a gubernatorial election in the current year or the next (the variable “IOU $\times$ Gov el. @t or $t + 1$ $\times$ App.”); the interaction of the fraction of the commission that is elected with whether the utility is investor-owned, and whether there is a gubernatorial election in the current year or the next (the variable “IOU $\times$ Gov el. @t or $t + 1$ $\times$ Elect.”); and the interaction of whether the utility is municipally owned and whether there is a mayoral election in the current year or the next. As expected, the impact of gubernatorial elections is greater for appointed commissions than elected commissions, although the effect is not statistically significant at conventional levels.

Prior studies have linked the magnitude of pre-election manipulations to corruption. For this reason, Regression (4) includes the interaction of the indicator for gubernatorial elections and the state’s corruption index, and finds lower election-year electricity prices in the most corrupt states. Since the highest corruption index is 5.5 (Rhode Island), this suggest that in this state, investor-owned electricity prices are 2.55% lower in gubernatorial election years. In contrast, the lowest corruption index is 1.5 (Colorado, South Dakota, and North Dakota) which suggest that in those states, investor-owned electricity prices are 1.05% higher in gubernatorial election years. Thus, the results are comparable to Shi and Svensson [2006] who find that the election-induced increase in fiscal deficits in a country is 1.9% of GDP for countries that have the average corruption

[14] Although in a few states, state regulators have some control over the price that the municipal utility charges outside the municipal boundaries.

level of a developing countries, versus 0.1% of GDP for countries that have the average corruption level of developed countries. Regression (5) include interactions between the state corruption index, gubernatorial elections, mayoral elections, and their lead, and the results remain largely unchanged.

Controlling for corruption also impacts the statistical significance of the findings. While elections impact investor owned utility more than municipal utilities, the difference is not statistically significant when factoring in the effect on less corrupt states. However, for states that have corruption index of 2.86 or higher (the mean is 3.6), the difference in election impact is statistically significant.

We may be concerned that over the time period, there is a change in the fraction of electricity sold to residential customers, and that this change is correlated with gubernatorial elections. If this were true, then it would bias the estimates. However, this does not appear to be the case since the results are similar when the regressions are estimated separately for residential and non-residential customers, see Tables 3–4.

More generally, there may be omitted variables that affect electricity prices and which are correlated with gubernatorial elections. However, the results still hold when estimating the regression in first-differences, thus alleviating concerns of omitted variable bias (Regression (5) in Tables 2–4).

The coefficients of our production costs variables are consistent with public utility pricing theory: higher energy input costs raise prices and the effect is greater for non-residential than residential customers. The same is true for the capital proxy: the higher the percent of electricity generated from fossils (and thus the lower capital expenditures) the lower the prices.

Table 5 includes the estimates of the impact of elections on average residential prices for the years 1964–1979 (sample 2) with state, city, year and period fixed effects (period is winter, summer or entire year). On this sample, gubernatorial election only affect investor-owned utility electricity prices for states that have appointed commissions. For this reason, I only report these results. One obtains noisier, although qualitatively similar results when examining the impact of elections in all States. These results tend to be larger in magnitude and more statistically significant than with the first sample, perhaps because the second sample provides prices by city and consumption level, rather than average prices over all cities served by a utility and over all consumption levels. We also obtain similar results when we estimate the regression in first differences (Table 6).

Political manipulation of electricity prices are costly since they raise the deadweight losses from the markups necessary to cover fixed costs and profits. Since the deadweight loss is quadratic in markup, the deadweight loss of a variable markup is greater than the deadweight loss of a constant markup which generates the same level of revenues, see Appendix. Deadweight losses are caused by changes in marginal prices and thus, the assertion that cycles in electricity pricing are costly, rests on the assumption that changes in average prices reflect changes in marginal prices. To provide further evidence of the welfare losses with private ownership, I regress marginal electricity prices on election dates. Investor-owned utilities charge higher marginal prices the year of a gubernatorial election or the year before (Table 7). Thus electoral manipulations have a detrimental effect on welfare (albeit of a small magnitude).

The coefficients of our production costs variables for our second sample are consistent with the theory of public utility pricing: higher energy input costs and higher levels of capital (as measured by a lower percent of electricity generated from fossils) lead to higher electricity prices. Further, the effect are larger in magnitude for marginal prices than average prices, and larger in magnitude for higher than lower consumption levels.

4.2 Speed of response of electricity prices to changes in costs

Price responses to changes in costs are first examined on the first sample. Table 8 includes the results of multinomial logit regression with three outcomes: kilowatt hour prices decrease by more than 0.1¢, change by less than 0.1¢, and increase by more than 0.1¢.[15] The explanatory variables are: the change in costs since the last rate change interacted with ownership type, indicator variables for the number of years since the last rate change, and year fixed effects. A 1¢ fall in energy costs leads to a 8% point increase in the likelihood that investor owned utilities cut residential prices, while a 1¢ raise leads to 11% point increase in the likelihood of a residential price hike. Municipal utilities are less likely to change residential rates than investor owned utilities:

[15] The results are qualitatively the same if we examine changes by more than 0.2¢.

a 1¢ fall in energy costs leads to a 5% point increase in the likelihood of a price cut, while 1¢ raise in input costs leads to a 6% point increase in the likelihood of a residential price hike. Similarly, lower capital costs, as measured by a 10% point raise in the share generated from fossils, lead to a 1% point increase in the probability of rate decrease, while a 10% fall in the share generated from fossils leads to a 2% increase in the likelihood of a rate increase.

Utilities are much more likely to change non-residential prices than residential in response to change in input costs. For investor owned utilities, a 1¢ decrease in input costs leads to a 40% point increase in the likelihood that investor owned utilities cut residential prices, while a 1¢ increase leads to 37% point increase in the likelihood of a residential price hike. Municipal utilities are less likely to change non-residential rates than investor owned utilities: a 1¢ decrease in input costs leads to a 19% point increase in the likelihood of a price cut, while 1¢ increase in input costs leads to a 17% point increase in the likelihood of a residential price hike.

Similar results hold for the second sample (Table 9–Table 11).[16] Since the data provides the actual rates, price hikes are defined as a positive change in price, rather that an increase by more than 0.1¢ per kWh. When quantity consumed is 750kWh, a 1¢ fall in input costs leads to a 4% point increase in the likelihood that investor owned utilities cut residential prices, while a 1¢ rise leads to 9% point increase in the likelihood of a residential price hike. Municipal utilities are less likely to change rates than investor owned utilities: the likelihood that a municipal utility lowers rates is unaffected by cost, while 1¢ rise in input costs leads to a 3% point increase in the likelihood of a residential price hike.

Thus, unlike the first measure of political distortion, we find evidence of inefficient pricing with municipal utilities. However, unlike the first measure, delays in responding to changes in costs may not necessarily indicate political inefficiencies but rather may be evidence of managerial inefficiencies or small-scale inefficiencies.

[16] The results are statistically significant at conventional levels except for monthly consumption of 250kWh and price reductions when monthly consumption is 100kWh.

5 Conclusion

Private firms are believed to suffer from fewer political distortions than government owned enterprises. In order to provide empirical evidence for this belief, I examine one of the very few large U.S. industries where both for-profit and government enterprises sell goods to the public: electric utilities. I follow the existing literature in measuring political distortions by lower electricity prices before elections and by delays in adjusting electricity prices to changes in input costs. Contrary to common belief, I find more evidence of electoral manipulations for private electric utilities than for government utilities.

I also provide a theoretical framework to explain our findings. Specifically, regulation of private utilities leads to political decisions being made at the state level, where individuals have more heterogeneous preferences and are less informed about the abilities and preferences of government officials. In contrast, for U.S. electric utilities, government ownership leads to decisions being made at the municipal level, where individuals have more homogenous preferences and are better informed about their officials. Further, lower pre-election electricity prices are more likely to be selected in heterogenous jurisdictions with more uninformed voters. Thus, my results suggest that private ownership may not always be an effective way to depoliticize economic activities when it is accompanied by more centralized political decisions.

The empirical nature of the study restricted the analysis to political distortions that can be measured for a large number of firms and years. However, prior theoretical and empirical work suggests that the political conditions that lead to manipulating electricity prices before elections would also lead to other more costly (but more difficult to observe) distortions. An example of a costly distortion is providing lower electricity rates to politically influential customers. While I do not provide evidence of such favoritism, I provide evidence that the manipulation of electricity prices around gubernatorial elections is more likely to occur in the most corrupt States. Thus these results parallel international evidence that manipulations of nations' budgets around elections is correlated with corruption [Shi and Svensson, 2006].

I replicate the finding that private utilities are more likely to increase prices in response to a rise in costs, than to decrease prices in response to a decline in costs [Joskow, 1974]. This results is not surprising since Peltzman [2000] finds this price asymmetry to costs in two out of every three markets he examined (out of 242 markets). Thus, in order to understand the significance of Joskow's finding, I compare the price rigidities of private electric utilities to public electric utilities, and find that, comparatively, private electricity prices are more responsive to changes in costs. Thus government utilities appear to have higher costs of changing rates ("menu costs"), because of political distortions, small scale, or managerial inefficiencies. Thus ownership type affects the speed of price adjustments, a factor that had not been previously examined in the literature on price rigidities.

Table 1: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.
	Sample 1 (1990–2014)			
Average price	10	5	2	101
Average residential price	11	5	3	101
Average non-residential price	9	5	-21	158
Residential price cut (= 100)	22	42	0	100
Residential price hike (= 100)	53	50	0	100
Non-residential price cut (= 100)	52	50	0	100
Non-residential price hike (= 100)	34	48	0	100
Average energy input cost	2	1	0	23
Δ Energy costs since last rate change	0	0	-2	2
% Fossil generated	75	21	0	100
Δ (% Fossil gen.) since last rate change	1	6	-48	77
Investor owned utility (= 100)	23	42	0	100
Investor owned + appointed regulator (= 100)	20	40	0	100
Municipal utility + Mayor term ≥ 4 (= 100)	45	50	0	100
Corruption index	3.6	1.0	1.5	5.5
	Sample 2 (1964–1979)			
Average price at 100kWh	25	5	3	119
250kWh	19	4	1	48
500kWh	14	3	3	35
750kWh	13	3	3	34
1,000kWh	12	3	3	33
Residential price cut (= 100)	14	34	0	100
Residential price hike (= 100)	54	50	0	100
Average energy input cost	3	2	0	11
Δ Energy costs since last rate change	0	1	-1	7
% Fossil generated	82	21	0	100
Δ (% Fossil) since last rate change	-1	5	-46	46
% Investor owned	83	38	0	100

Prices and average energy input cost are in ¢ per kWh (2012 dollars). See text for references.

Table 2: Gubernatorial elections have a greater impact on investor-owned (IOU) electricity prices than mayoral and gubernatorial elections' impact on municipal utilities (MUNI) prices (sample years 1990–2014)

	(1)	(2)	(3)	(4)	(5)	(6)
IOU × (Governor election)	-0.007*	-0.007*		0.024**	0.032**	-0.008**
	(0.004)	(0.004)		(0.009)	(0.013)	(0.003)
IOU × (Gov. elect.) × Corruption				-0.009***	-0.011***	
				(0.002)	(0.003)	
IOU × (Governor election @ $t+1$)	-0.005	-0.004		-0.007	0.018	-0.006
	(0.005)	(0.005)		(0.005)	(0.018)	(0.005)
IOU × (Gov. el. @ $t+1$) × Corruption					-0.007	
					(0.005)	
Muni × (Governor election)		0.001				
		(0.002)				
Muni × (Governor election @ $t+1$)		0.005*				
		(0.003)				
Muni × (Mayor election)	-0.005*	-0.005*		-0.004*	-0.004	-0.004*
	(0.002)	(0.003)		(0.002)	(0.010)	(0.002)
Muni × (Mayor elect.) × Corrupt.					-0.000	
					(0.003)	
Muni × (Mayor election @ $t+1$)	-0.000	0.000		-0.001	-0.003	-0.003
	(0.002)	(0.002)		(0.002)	(0.007)	(0.002)
Muni × (Mayor el. @ $t+1$) × Corrupt.					0.001	
					(0.002)	
IOU × (Gov el. @t or $t+1$) × App.			-0.007			
			(0.004)			
IOU × (Gov el. @t or $t+1$) × Elect.			-0.003			
			(0.008)			
Muni × (Mayor el. @t or $t+1$)			-0.003			
			(0.002)			
IOU × Appointed commission			0.082***			
			(0.010)			
Energy input cost	0.099***	0.099***	0.102***	0.103***	0.103***	
	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)	
Δ Energy input cost						0.046***
						(0.017)
% Fossil generated	-0.027**	-0.027**	-0.026**	-0.028**	-0.028**	
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	
Δ % Fossil generated						-0.018**
						(0.009)
R-squared	0.87	0.87	0.87	0.87	0.87	0.08
N. of observations	22,134	22,134	21,784	21,418	21,418	21,149
Estimation	FE	FE	FE	FE	FE	FD

The unit of observation is the utility-state-year. The average prices and energy input cost for electricity are in logs. "IOU" and "Muni" are indicator variables for whether the utility is investor-owned or municipal. Fixed-effect estimates (FE) include include utility-state, city, and year fixed effects, while first-differences estimates (FD) include year fixed effects. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 3: Gubernatorial elections have a greater impact on investor-owned (IOU) *residential* prices than mayoral and gubernatorial elections' impact on municipal utilities (MUNI) prices (sample years 1990–2014)

	(1)	(2)	(3)	(4)	(5)	(6)
IOU × (Governor election)	-0.005	-0.006		0.014*	0.018	-0.007***
	(0.004)	(0.004)		(0.008)	(0.012)	(0.002)
IOU × (Gov. elect.) × Corruption				-0.005**	-0.007**	
				(0.002)	(0.003)	
IOU × (Governor election @ $t+1$)	-0.004	-0.002		-0.005	0.008	-0.005
	(0.005)	(0.005)		(0.004)	(0.017)	(0.005)
IOU × (Gov. el. @ $t+1$) × Corruption					-0.004	
					(0.005)	
Muni × (Governor election)		-0.001				
		(0.002)				
Muni × (Governor election @ $t+1$)		0.003				
		(0.002)				
Muni × (Mayor election)	-0.002	-0.003		-0.002	0.000	-0.004*
	(0.002)	(0.003)		(0.002)	(.)	(0.002)
Muni × (Mayor elect.) × Corrupt.					0.000	
					(0.003)	
Muni × (Mayor election @ $t+1$)	0.000	0.000		0.000	0.000	-0.003
	(0.002)	(0.003)		(0.003)	(.)	(0.003)
Muni × (Mayor el. @ $t+1$) × Corrupt.					-0.000	
					(0.002)	
IOU × (Gov el. @t or $t+1$) × App.			-0.004			
			(0.004)			
IOU × (Gov el. @t or $t+1$) × Elect.			-0.006			
			(0.008)			
Muni × (Mayor el. @t or $t+1$)			-0.002			
			(0.002)			
IOU × Appointed commission			0.081***			
			(0.009)			
Energy input cost	0.089***	0.089***	0.093***	0.093***	0.093***	
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	
Δ Energy input cost						0.040**
						(0.015)
% Fossil generated	-0.019*	-0.019*	-0.018*	-0.020**	-0.020**	
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	
Δ % Fossil generated						-0.014**
						(0.006)
R-squared	0.87	0.87	0.88	0.87	0.87	0.06
N. of observations	21,635	21,635	21,285	20,933	20,933	20,651
Estimation	FE	FE	FE	FE	FE	FD

The unit of observation is the utility-state-year. The average prices and energy input cost for electricity are in logs. "IOU" and "Muni" are indicator variables for whether the utility is investor-owner or municipal. Fixed-effect estimates (FE) include include utility-state, city, and year fixed effects, while first-differences estimates (FD) include year fixed effects. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4: Gubernatorial elections have a greater impact on investor-owned (IOU) *non-residential* prices than mayoral and gubernatorial elections' impact on municipal utilities (MUNI) prices (sample years 1990–2014)

	(1)	(2)	(3)	(4)	(5)	(6)
IOU × (Governor election)	-0.008**	-0.009**		0.019	0.029**	-0.008*
	(0.004)	(0.004)		(0.012)	(0.013)	(0.005)
IOU × (Gov. elect.) × Corruption				-0.007**	-0.010***	
				(0.003)	(0.003)	
IOU × (Governor election @ $t+1$)	-0.009	-0.008		-0.011*	0.019	-0.010*
	(0.006)	(0.006)		(0.006)	(0.019)	(0.005)
IOU × (Gov. el. @ $t+1$) × Corruption					-0.008	
					(0.006)	
Muni × (Governor election)		-0.001				
		(0.002)				
Muni × (Governor election @ $t+1$)		0.004*				
		(0.002)				
Muni × (Mayor election)	-0.005*	-0.005*		-0.006**	-0.003	-0.003
	(0.003)	(0.003)		(0.003)	(0.010)	(0.003)
Muni × (Mayor elect.) × Corrupt.					-0.001	
					(0.002)	
Muni × (Mayor election @ $t+1$)	-0.003	-0.002		-0.003	0.001	-0.004*
	(0.003)	(0.003)		(0.003)	(0.010)	(0.002)
Muni × (Mayor el. @ $t+1$) × Corrupt.					-0.001	
					(0.002)	
IOU × (Gov el. @t or $t+1$) × App.			-0.009**			
			(0.004)			
IOU × (Gov el. @t or $t+1$) × Elect.			-0.005			
			(0.008)			
Muni × (Mayor el. @t or $t+1$)			-0.004			
			(0.003)			
IOU × Appointed commission			0.086***			
			(0.012)			
Energy input cost	0.112***	0.112***	0.116***	0.111***	0.111***	
	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	
Δ Energy input cost						0.050***
						(0.018)
% Fossil generated	-0.038**	-0.038**	-0.037**	-0.036**	-0.036**	
	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	
Δ % Fossil generated						-0.021*
						(0.011)
R-squared	0.83	0.83	0.83	0.83	0.83	0.06
N. of observations	21,623	21,623	21,273	20,922	20,922	20,635
Estimation	FE	FE	FE	FE	FE	FD

The unit of observation is the utility-state-year. The average prices and energy input cost for electricity are in logs. "IOU" and "Muni" are indicator variables for whether the utility is investor-owner or municipal. Fixed-effect estimates (FE) include include utility-state, city, and year fixed effects, while first-differences estimates (FD) include year fixed effects. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5: Average *residential* electricity prices for investor-owned utilities (IOU) are lower before gubernatorial elections while municipal utilities (Muni) are unaffected by mayoral elections, where prices are computed for monthly consumption of 100, 250, 500, 750, and 1,000 kWh (sample years 1964–1979)

	(1)	(2)	(3)	(4)	(5)
	100kWh	250kWh	500kWh	750kWh	1,000kWh
IOU × (Governor election)	-0.009*	-0.011**	-0.011	-0.010	-0.010
	(0.004)	(0.004)	(0.006)	(0.007)	(0.007)
IOU × (Governor elect. @ $t+1$)	-0.009*	-0.009**	-0.011**	-0.012**	-0.012**
	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)
Muni × (Mayor election)	0.001	-0.000	0.000	-0.003	-0.006
	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
Muni × (Mayor election @ $t+1$)	-0.002	0.002	0.001	0.001	-0.000
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Energy input cost	0.010	0.046	0.101**	0.126***	0.136***
	(0.060)	(0.044)	(0.040)	(0.039)	(0.042)
% Fossil generated	-0.032	-0.079**	-0.111***	-0.127***	-0.135***
	(0.044)	(0.033)	(0.032)	(0.032)	(0.034)
Investor owned utility (IOU)	0.051***	0.049**	0.029	0.041	0.052**
	(0.019)	(0.022)	(0.024)	(0.025)	(0.026)
R-squared	0.80	0.84	0.82	0.84	0.85
N. of observations	93,196	93,196	93,196	93,196	93,196

The unit of observation is the utility-city-year-period, where period is winter, summer, or entire year. The average price of electricity is in logs. The regressions include state, city, year and period fixed effects, and the interaction between year fixed effects and the fraction of electricity in a state-year produced using coal, gas, and oil. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6: Average *residential* electricity prices for investor-owned utilities (IOU) are lower before gubernatorial elections while municipal utilities (Muni) are unaffected by mayoral elections, when estimated in *first-differences*, where prices are computed for monthly consumption of 100, 250, 500, 750, and 1,000 kWh (sample years 1964–1979)

	(1)	(2)	(3)	(4)	(5)
	100kWh	250kWh	500kWh	750kWh	1,000kWh
IOU × (Governor election)	0.006	0.004	0.005	0.008	0.007
	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)
IOU × (Governor elect. @ $t+1$)	-0.011*	-0.012**	-0.014**	-0.014**	-0.014**
	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
Muni × (Mayor election)	0.002	-0.005	-0.001	-0.001	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Muni × (Mayor election @ $t+1$)	-0.002	-0.001	0.000	0.003	0.003
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Δ Energy input cost	-0.015	-0.004	-0.000	0.001	0.002
	(0.014)	(0.014)	(0.016)	(0.016)	(0.015)
Δ % Fossil generated	0.010	0.007	0.005	0.002	0.001
	(0.014)	(0.015)	(0.016)	(0.017)	(0.017)
Investor owned utility (IOU)	0.005	-0.000	0.002	0.002	0.002
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
R-squared	0.21	0.29	0.31	0.34	0.35
N. of observations	83,387	83,387	83,387	83,387	83,387

The unit of observation is the utility-city-year-period, where period is winter, summer, or entire year. The average price of electricity is in logs. The regressions include state, city, year and period fixed effects, and the interaction between year fixed effects and the fraction of electricity in a state-year produced using coal, gas, and oil. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7: *Marginal residential* electricity prices for investor-owned utilities (IOU) are lower before gubernatorial elections, where prices are computed for monthly consumption of 100, 250, 500, and 750 kWh (sample years 1964–1979)

	(1) 100kWh	(2) 250kWh	(3) 500kWh	(4) 750kWh
IOU × (Governor election)	-0.014**	-0.008	-0.009	-0.010
	(0.006)	(0.012)	(0.010)	(0.009)
IOU × (Governor elect. @ $t+1$)	-0.009*	-0.010	-0.015**	-0.012**
	(0.005)	(0.012)	(0.007)	(0.006)
Muni × (Mayor election)	-0.002	-0.002	-0.012	-0.018
	(0.007)	(0.009)	(0.013)	(0.014)
Muni × (Mayor election @ $t+1$)	0.005	-0.003	0.001	-0.003
	(0.007)	(0.008)	(0.010)	(0.010)
Energy input cost	0.094**	0.212***	0.196***	0.176***
	(0.039)	(0.078)	(0.060)	(0.064)
% Fossil generated	-0.141***	-0.135**	-0.171***	-0.161***
	(0.036)	(0.061)	(0.049)	(0.050)
Investor owned utility (IOU)	0.046	-0.006	0.077**	0.096**
	(0.029)	(0.040)	(0.036)	(0.039)
R-squared	0.82	0.81	0.82	0.83
N. of observations	93,178	92,763	93,196	93,194

The unit of observation is the utility-city-year-period, where period is winter, summer, or entire year. The average price of electricity is in logs. The regressions include state, city, year, and period fixed effects, and the interaction between year fixed effects and the fraction of electricity in a state-year produced using coal, gas, and oil. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8: Average *non-residential* prices for investor-owned utilities are more responsive to energy costs than municipal utilities utilities' average prices (sample years 1990–2014)

	Residential		Non-residential	
	Price cut	Price hike	Price cut	Price hike
Δ Energy costs	-0.076***	0.106***	-0.347***	0.351***
	(0.027)	(0.035)	(0.101)	(0.106)
Muni × Δ Energy costs	0.026*	-0.044**	0.194***	-0.194**
	(0.015)	(0.018)	(0.066)	(0.079)
Δ % Fossil generated	0.001*	-0.002*	0.006***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.002)
Muni × Δ % Fossil gen.	-0.001	0.001	-0.004**	0.004*
	(0.001)	(0.002)	(0.002)	(0.002)
Muni	-0.051***	0.012	-0.041***	0.037***
	(0.014)	(0.011)	(0.013)	(0.013)
Price last changed @ $t-1$	0.160***	0.148***	-0.119***	0.173***
	(0.060)	(0.053)	(0.031)	(0.039)
Price last changed @ $t-2$	0.112*	0.090*	-0.083**	0.126***
	(0.060)	(0.054)	(0.034)	(0.041)
Price last changed @ $t-3$	0.083	0.040	-0.044	0.052
	(0.065)	(0.056)	(0.030)	(0.038)
Price last changed @ $t-4$	0.012	0.063	-0.038	0.039
	(0.063)	(0.056)	(0.040)	(0.051)
Price last changed @ $t-5$	0.018	0.128	-0.103	0.114*
	(0.079)	(0.088)	(0.065)	(0.064)
Price last changed @ $t-6$	0.045	0.000	0.000	0.000
	(0.079)	(0.077)	(.)	(.)
N. of observations	19,583	19,583	19,560	19,560

The unit of observation is the utility-state-year. "Muni" is an indicator variables for whether the utility is municipally owned. The regression include year fixed effects. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 9: Average *residential* prices for investor-owned utilities are more responsive to changes in costs than municipal utilities average prices, where prices are computed for monthly consumption of 100 and 250 kWh (sample years 1964–1979)

	100 kWh		250 kWh	
	Price cut	Price hike	Price cut	Price hike
Δ Energy costs	0.016	0.077***	0.002	0.051
	(0.028)	(0.028)	(0.025)	(0.039)
Muni $\times$ Δ Energy costs	-0.016	-0.050**	-0.019	-0.012
	(0.027)	(0.022)	(0.028)	(0.037)
Δ % Fossil generated	0.005**	-0.005***	0.008***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.004)
Muni $\times$ Δ % Fossil gen.	-0.003	0.002	-0.008***	0.012***
	(0.002)	(0.002)	(0.002)	(0.004)
Muni	-0.053***	-0.080**	-0.033**	-0.124***
	(0.018)	(0.036)	(0.016)	(0.026)
Price last changed @ $t-1$	0.144***	0.085*	0.122***	0.056
	(0.043)	(0.047)	(0.036)	(0.048)
Price last changed @ $t-2$	0.140**	-0.049	0.015	-0.014
	(0.060)	(0.081)	(0.040)	(0.070)
Price last changed @ $t-3$	0.203***	-0.215**	0.173***	-0.162
	(0.066)	(0.100)	(0.057)	(0.099)
Price last changed @ $t-4$	0.117	-0.068	-0.117**	0.067
	(0.090)	(0.081)	(0.059)	(0.086)
Price last changed @ $t-5$	-0.096	0.070	-0.132	0.082
	(0.096)	(0.076)	(0.093)	(0.071)
Price last changed @ $t-6$	-0.184*	0.153*	-0.129	0.026
	(0.106)	(0.078)	(0.081)	(0.112)
N. of observations	63,688	63,688	66,506	66,506

The unit of observation is the city-state-year-utility. "Muni" is an indicator variables for whether the utility is municipally owned. The regression included year fixed effects. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 10: Average *residential* prices for investor-owned utilities are more responsive to changes in costs than municipal utilities average prices, where prices are computed for monthly consumption of 500 and 750 kWh (sample years 1964–1979)

	500 kWh		750 kWh	
	Price cut	Price hike	Price cut	Price hike
Δ Energy costs	-0.046***	0.081***	-0.044***	0.090***
	(0.016)	(0.027)	(0.016)	(0.027)
Muni $\times$ Δ Energy costs	0.039**	-0.051**	0.046**	-0.060***
	(0.020)	(0.024)	(0.021)	(0.023)
Δ % Fossil generated	0.002	-0.008**	0.003	-0.009**
	(0.002)	(0.003)	(0.002)	(0.004)
Muni $\times$ Δ % Fossil gen.	-0.003	0.008**	-0.004*	0.009**
	(0.002)	(0.003)	(0.002)	(0.004)
Muni	-0.051***	-0.129***	-0.056***	-0.118***
	(0.013)	(0.025)	(0.017)	(0.028)
Price last changed @ $t-1$	0.076	0.083	0.165***	0.046
	(0.066)	(0.062)	(0.049)	(0.056)
Price last changed @ $t-2$	-0.042	0.063	0.063	-0.009
	(0.071)	(0.067)	(0.055)	(0.056)
Price last changed @ $t-3$	0.100	-0.140**	0.168***	-0.160***
	(0.071)	(0.065)	(0.054)	(0.053)
Price last changed @ $t-4$	-0.069	0.008	0.014	-0.050
	(0.090)	(0.087)	(0.068)	(0.070)
Price last changed @ $t-5$	-0.224***	0.152**	-0.089	0.060
	(0.087)	(0.065)	(0.070)	(0.046)
Price last changed @ $t-6$	-0.113	0.005	-0.137	0.024
	(0.093)	(0.110)	(0.104)	(0.102)
N. of observations	68,007	68,007	69,409	69,409

The unit of observation is the city-state-year-utility. "Muni" is an indicator variables for whether the utility is municipally owned. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 11: Average *residential* prices for investor-owned utilities are more responsive to changes in costs than municipal utilities average prices, where prices are computed for monthly consumption of 1,000 kWh (sample years 1964–1979)

	1,000 kWh	
	Price cut	Price hike
Δ Energy costs	-0.060***	0.099***
	(0.020)	(0.025)
Muni $\times$ Δ Energy costs	0.052**	-0.064***
	(0.026)	(0.023)
Δ % Fossil generated	0.002	-0.008**
	(0.002)	(0.003)
Muni $\times$ Δ % Fossil gen.	-0.002	0.007**
	(0.002)	(0.003)
Muni	-0.057***	-0.116***
	(0.015)	(0.027)
Price last changed @ $t-1$	0.156***	0.058
	(0.048)	(0.053)
Price last changed @ $t-2$	0.099*	-0.034
	(0.054)	(0.050)
Price last changed @ $t-3$	0.148**	-0.129**
	(0.063)	(0.060)
Price last changed @ $t-4$	0.036	-0.087
	(0.063)	(0.067)
Price last changed @ $t-5$	-0.106	0.076*
	(0.069)	(0.046)
Price last changed @ $t-6$	-0.098	-0.005
	(0.084)	(0.091)
N. of observations	69,794	69,794

The unit of observation is the city-state-year-utility. "Muni" is an indicator variables for whether the utility is municipally owned. Standard errors are clustered at the state level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

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Appendix: Computation of the deadweight loss from cycling of electricity prices

Efficient electricity pricing entails a constant markup over marginal cost (this is second best because charging marginal cost is infeasible with increasing returns [Baumol and Bradford, 1970]). Thus, delaying price increase until after an election leads utilities to charge a variable markup and thus to welfare losses. This is shown below using the formula for deadweight losses.

Specifically, denote marginal cost by "mc," Q_{mc} if the quantity sold when price is equal to marginal cost, Q is the quantity sold when price is $P >$ mc, and Q' is the quantity sold when price is $P + \Delta P >$ mc. Note that

$$Q \approx Q_{MC} + \frac{P - \text{mc}}{P}\epsilon Q \text{ and } Q' \approx Q_{MC} + \frac{P + \Delta P - \text{mc}}{P}\epsilon Q.$$

Then, deadweight loss when prices are P as a fraction of revenues, PQ, is equal to

$$\begin{aligned} \frac{1}{2}\frac{(P - mc) \times (Q_{mc} - Q)}{PQ} &\approx \frac{1}{2}\frac{(P - \text{mc}) \times (Q - (P - \text{mc})(Q/P)\epsilon - Q)}{PQ} \\ &= -\frac{1}{2}\epsilon\Big(\frac{P - \text{mc}}{P}\Big)^2, \end{aligned}$$

while the deadweight loss when prices are $P + \Delta$ as a fraction of revenues, PQ, is equal to

$$-\frac{1}{2}\epsilon\Big(\frac{P + \Delta P - \text{mc}}{P}\Big)^2,$$

The change in the deadweight loss of by changing prices from P to $P + \Delta P$ is thus

$$-\frac{1}{2}\epsilon\Big[\Big(\frac{P + \Delta P - \text{mc}}{P}\Big)^2 - \Big(\frac{P - \text{mc}}{P}\Big)^2\Big] = -\frac{1}{2P^2}\epsilon[2\Delta P(P - \text{mc}) + (\Delta P)^2].$$

This formula allows us to compute the deadweight loss of a political price cycle in a city where the elected official has a four year term in office. Specifically, we compare the deadweight loss of charging a lower price in an election year to the deadweight loss of charging the same prices every year. To do so, we examine the change in the deadweight loss of charging prices of $P(1-\tau) > \text{mc}$ in an election year and $P(1+\tau/3)$ in other years. Then, $E\Delta P = 0$ and $E(\Delta P/P^2)^2 = (1/4)\tau^2 + (3/4)(\tau^2/9) = (1/3)\tau^2$. Hence, the deadweight loss of cycling prices is $-\epsilon\frac{1}{6}\tau^2$.