Commissioner Selection and Deregulation of Gas Utilities

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This study evaluates the role of reelection motives of state public service commissioners in the recent pattern of deregulation in the gas distribution market. Competing-risk hazard models are used to explain when and which regulatory regime – retail restructuring, price cap or sliding-scale regulation – state commissions adopt to deregulate individual utilities. The system of selection of state commissioners, frequency and timing of elections, and composition of commissions and state legislatures are evaluated as determinants of commissioners' political and reelection motives. Frequency of elections is associated positively with the risk of all forms of deregulation, albeit with different time delay. In election years, the risk of adopting price caps rises immediately, while that of restructuring rises later. Public elections are found to favor price caps, while appointments by state legislature favor restructuring. Democratic-leaning commissions and legislatures appear to avoid restructuring in favor of price caps, perhaps due to their doubt over the prospect of effective competition, or due to incidental spatial correlations.

Keywords: gas, policy reform, deregulation, restructuring, commissioner elections, hazard model

JEL Classification: D72, L50, L95

Since the early 1990s, regulation of public utilities in the United States has undergone a change in structure and conceptual approach. Many state public service commissions abandoned traditional cost-plus ratemaking for performance-based regulation. Across utility industries, regulators adopted different deregulatory regimes, with consideration for physical properties of the commodity, industry cost structure, prospect for technological progress, prospect for effective competition, and other factors. In the gas distribution industry alone, some commissions fixed prices that utilities could charge, some introduced financial incentives for utilities to exceed certain performance standards, and others allowed utilities to compete among themselves for customers.

The first large-scale incentive programs in the gas distribution industry were introduced in the mid-1990s. Half of U.S. states and one third of utilities have undertaken deregulation since then, citing economic reasons and positive demonstration effects from surrounding markets. Political goals of self-interested regulators may have contributed, as sizeable theoretical literature suggests. Unfortunately, theoretical studies fail to differentiate among the many factors at play to explain the observed pattern of deregulation over time and across states. Empirical studies conducted in the electricity and telecommunications industries also do not extend directly to the gas market, given significant conceptual and empirical differences across the industries. The study of regulatory reform in the gas distribution market is relevant in itself in light of the recent wave of deregulation in the industry; the heterogeneity of regulation across states; the significance of gas in heating and energy generation (particularly since the discovery of shale reserves); and high observed volatility in gas prices.

This paper contributes empirical evidence on factors behind regulatory reform in gas distribution, and in utility industries in general. It investigates why state commissioners choose particular forms of deregulation or retain status quo at a particular point in time, and attempts to isolate the role of commissioners' reelection motives in this choice. This can help us determine the relative importance of economic 'public interest' motives, and of 'regulatory capture' motives in bringing about regulatory reform. This understanding can also help us predict future patterns of deregulation. As a byproduct, it can tell us the extent of any bias in existing literature from treating regulation status as exogenous.

The empirical analysis uses 1996-2004 panel data on all gas distribution companies in the continental United States, and competing-risk hazard regressions to estimate the timing and form of deregulation at each regulator-utility pair. State-level political and economic factors are evaluated as explanatory variables. The system of selection of state commissioners, and frequency and timing of elections are found to affect the pattern of deregulation significantly, implying that regulatory capture motives matter. Shorter commissioner terms are favorable to any form of deregulation compared to the benchmark – suggesting that commissioners view deregulatory effort as important for their reelection prospects – but the timing of deregulation varies by deregulation type. Risk of adoption of price caps is higher in election years, while that of restructuring is lower immediately but rises in the following years. Perhaps in agreement, public elections of commissioners appear to favor price caps, while appointments by state legislature – without voters' immediate input – appear to favor restructuring.

Among other results, Democratic-leaning commissions and state legislatures appear to avoid restructuring in favor of price caps, perhaps due to their mistrust of competitive forces in the gas market, or due to incidental spatial correlations. Smaller-staff commissions appear to shy away from restructuring, perhaps because of their limited resources, and complexity of full-blown restructuring. Among economic controls, utilities' prices and size, and market concentration contribute in expected ways to explaining the timing and type of regulatory reform, in line with 'public interest' explanations. Utilities' prices, size and market concentration are associated positively with the risk of utility-level deregulation, negatively or insignificantly with the risk of introducing competition. Finally, fiscal conditions in states, and demonstration effects from other utility industries and surrounding states also contribute.

The paper is organized as follows. Sections 1 and 2 review the background of regulation in the gas distribution industry, and our up-to-date understanding of regulators' reasons for policy reform, to motivate the following empirical analysis. Section 3 describes an estimable model of hazard of deregulation, and data issues. Section 4 presents main results, and Section 5 elaborates on their implications and limitations, and concludes with directions for future research.

1. Background of utility regulation

Since the 19th century, regulation of transportation and distribution companies in utility industries has fallen under the authority of state public service commissions. The primary objective of commissions was historically to protect core (i.e., residential and small commercial) customers from being abused to the benefit of larger consumers or utilities themselves. Over time, commissions took on more responsibilities, with regard to infrastructure provision, enforcement of efficiency at companies, and limited redistribution (cross-subsidization) across consumer classes. Commissions have adopted different regulatory approaches across different utility industries, depending on the complexity of service to consumers, ownership and cost of key assets, and prospect for technological innovation and competition, but plausibly also depending on inducements and pressure from industry interest groups (Stigler and Friedland 1962; McCraw 1975; Priest 1993).

The decision-making environment in which commissions operate has also varied across U.S. states, affecting regulatory processes and policy choices there. Commissions vary significantly in the resources and staff available to them, their hierarchy, political composition, tenure, system of selection, and prospects for reelection. Commissions are made up of three to seven commissioners (mean 3.96) operating independently in different utility sectors or in different geographies (and are typically formally led by a chairperson from their midst). Some states impose constraints on the political composition of their commissions. Commissioners serve for three to eight years (mean 5.40), and may be eligible for reelection to none, one or two consecutive terms. Commissioners are appointed or confirmed by state senators (in 38 states, including DC), or elected by the public (13 states).[1] Last not but least, regulatory experience – own and from nearby states – varies across commissions and over time, affecting regulatory choices.

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Republican commissioners	83	97	97	99	94	107	95	102	90
Democratic commissioners	105	99	94	91	84	91	87	90	85
Percent of commissioners Dem.	53%	48%	48%	48%	45%	45%	46%	47%	49%
Percent Dem. in state senate	51%	51%	51%	51%	51%	51%	49%	49%	49%
Commissioner appointments	32	46	44	62	29	62	41	58	37
Successful reappointments to consecutive terms	17	12	18	21	12	25	17	14	15
Appointed (as percent of commissioners in a year)	15%	25%	21%	31%	15%	30%	20%	33%	30%
Reappointed to consecutive terms	8%	8%	9%	13%	6%	11%	7%	9%	11%

Sources: NARUC (2010), Beecher (2007, 2010), public service commissions' websites, US Census.

Table 1. Party Composition of State Commissions and Commissioner Appointments, by Year

[1] Table 1 reports some trends in the composition and appointment of commissions during our sample period, 1996-2004. The table shows that 15-33% of commissioner seats nationwide are reassigned each year. While it is unclear how many commissioners seek reappointment after their term expires – or how actively – Table 1 reports the number of successful reappointments. Among all commissioners, 6-13% are re-appointed successfully to new terms each year.

Until the 1970s, state commissions kept the gas distribution market under rate-of-return regulation, because of the industry's status as classic natural monopoly. As the national gas market became more integrated, state officials, consumer advocates and utilities themselves started calling for lighter-handed, more flexible and more efficient regulatory regimes.[2] Price caps became debated as a superior form of regulation, as they gave utilities the full reward for efficiency in capital investment and in risk-taking in gas procurement and infrastructure management. The difference between price caps and rate-of-return regulation was, in reality, dampened by regulatory imperfections and constraints. Regulatory lags, rate case moratoria and prudence reviews reduced the efficiency disadvantages of rate-of-return regulation. Accounting for uncontrollable costs in the calculation of rates, and possibility of ex post renegotiation of allowed rates reduced the utilities' incentives under price caps. Even though price cap regulation required less regulatory oversight than rate-of-return regulation, it did not represent true regime change because – theoretically and empirically – it did not depart sufficiently from the rate-of-return regulation paradigm (Liston 1993). Companies' costs and their allowed rates remained tied, and companies' sunk investments remained protected by a safety net. Price-cap regulation also required regulators to correctly predict future costs and technology improvements, else utilities could earn excessive returns or default on their responsibilities. Because of such reservations, price caps were adopted in a haphazard fashion in the United States (Crew and Kleindorfer 1996).

In the mid-1990s, several state commissions started advancing performance-based regulation to give utilities incentives in particular areas of operation. Rewards for outstanding performance

[2] In 1978, the National Energy Act unified the intrastate and interstate transmission markets, and Orders 380 and 436 gave gas providers open access to transmission companies' pipelines. Through the 1978 Natural Gas Policy Act and the 1989 Wellhead Decontrol Act, wellhead prices became competitive. Utilities' options for using their resources and procuring commodity widened. The 1992 Federal Energy Regulatory Commission Order 636 extended utilities' access to interstate transmission, and simplified price structure in transmission.

were reflected in utilities' allowed consumer rates. The first stab at such deregulation, capacity-release and off-system sale plans, allowed utilities to share benefits from exceptional performance in utilization of marginal resources. Some states introduced monetary rewards for superb customer service. When these programs were deemed successful, more aggressive incentive programs were authorized to give utilities a wider space for decision-making, such as attracting off-system industrial customers, and purchasing the commodity from various sources. Utilities were allowed to influence their rate of return on capital by retaining a portion – according to a sliding scale – of the difference between actual and benchmark costs or revenues (Comnes *et al.* 1995).

Sliding-scale programs currently used by state commissions have several major variations. Margin-sharing plans promote efficient management and divestiture of resources on the margin: Off-system sales and pipeline capacity release plans reward utilities for using excess gas or capacity in their pipelines. Gas-cost incentive mechanisms offer utilities an incentive for efficient gas procurement, in commodities, futures and derivatives markets. Earnings-sharing mechanisms encourage negotiation of special contracts with new industrial customers to make gas competitive with other fuels. Once again, adoption of sliding-scale programs did not represent a true regulatory reform, merely partial, controlled deregulation. Similarly to price-cap regulation, sliding-scale plans retained much of the link between companies' costs and prices, and continued to restrict companies' returns to be within certain ranges. Sliding-scale programs may effectively be viewed as a compromise between rate-of-return and price-cap regulation.

Between 1992 and 1996, the Energy Policy Act and a series of regulations by the Federal Energy Regulatory Commission[3] prepared ground for competition in distribution markets,

[3] This includes the Regional Transmission Group Policy Statement (1993), Recovery of Stranded Costs by Public Utilities and Transmitting Utilities – Notice of Proposed Rulemaking (1994), Transmission Pricing Policy Statement

overturning the notion that utilities need to be regulated as natural monopolies. By 1997, some state commissions started unbundling gas distribution into several service areas, and approving multiple utilities and independent marketers to compete in individual segments. Introduction of consumer-choice programs represented true regulatory reform, as it introduced changes to the treatment of individual utilities, industry-wide structural changes, and changes to state commissions' role. Moreover, entry of unregulated interstate marketers gave states access to new sources of gas, undercut existing vertical regional supply chains, and helped to further unify the gas market.

Consumer choice programs have become the most common type of deregulation in the gas distribution industry across the U.S. Nevertheless, some states appear determined to retain traditional rate-of-return regulation, or have adopted competing policies, signaling that they do not intend to restructure their markets anytime soon. Restructuring presents administrative and technological challenges, and risks that some state commissions cannot or do not want to bear. Restructuring requires open access to facilities and prospect of effective competition, and cannot be applied easily to a single company. Outcome of restructuring is difficult to identify, and can take years to realize, because restructuring has significant spillovers even on utilities not covered by it. One possible interpretation of this study is that it evaluates factors that lead states to restructure, controlling for the fact that states have at least two real alternatives: keeping rate-of-return regulation, and adopting price caps.

2. Regulatory choice literature

(1994), Pooling Notice of Inquiry (1994), Notice of Proposed Rulemaking and Supplemental Notice of Proposed Rulemaking: Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities, and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities (1995), and Notice of Inquiry on Merger Policy (1996).

Most research on public utilities has focused on the electric and telecommunications industries, and has evaluated performance of alternative regulatory regimes rather than reasons for their adoption. Hlasny (2008b) reviews these studies. Across different utility industries, theoretical studies have identified various economic and political factors responsible for regulatory reform (Bailey and Pack 1995; Hlasny 2011a). The political drivers include: party in power and composition of public service commissions (Harris and Navarro 1983; Holburn and Vanden Bergh 2006); commissioner re-elections (Hagerman and Ratchford 1978); pressure from various interest groups (Stigler 1971; Hilton 1972; Posner 1974; Dal Bo 2006); and satisfaction with restructuring in surrounding states or industries (Flippen and Mitchell 2003).

Empirical evidence of political causes of deregulation has been mixed. In the electricity industry, process of regulator-selection has had little impact on the stringency of regulation in terms of consumer prices (Costello 1984; Primeaux *et al.* 1984; Primeaux and Mann 1986; Boyes and McDowell 1989; Kwoka 2002) and the allowed rates of return (Joskow 1972; Hagerman and Ratchford 1978; Harris and Navarro 1983), but some impact on the frequency of rate reviews (Atkinson and Nowell 1994; Leaver 2009). Stringency of regulation was found to affect utilities' availability of capital and borrowing costs unfavorably (Navarro 1982). In the telecommunications industry, effects of the regulator-setting process on pricing (Smart 1994; Campbell 1996; Quast 2008) and on restructuring efforts (Hlasny 2011b) have been identified.

The effect of commissioner selection process is unclear. Some studies found that elected commissioners tended to favor consumers to utilities (surveyed in Besley and Coate, 2003), or that they succumbed to pressure from utilities. The latter could happen due to commissioners' revolving-door motives, attempts to secure campaign contributions, or lack of consideration for uninformed voters (Campbell 1996). Appointed commissions tended to either decide in favor of state senators rather than voters per se, or clamp down on utilities and favor consumers. Primeaux *et al.* (1984) found that elected commissions promoted agendas favorable to the electorate and tended to speed up competition, while appointed commissions retained status quo regulation.

In regard to the composition of state commissions, some less significant patterns were noted. Commission size was related positively to the complexity of achievable regulatory outcomes (Berry 1979; Gormley 1983), but also to prices, as pressure from consumer representatives gets diluted among more commissioners (Kwoka 2002). Political affiliation of commissions was estimated to have insignificant effects on the desirability of regulatory outcomes, or effects contrary to theoretical expectations (Campbell 1996; Atkinson and Nowell 1994).[4]

Empirical studies of the gas industry are notably lacking, particularly those evaluating political drivers of regulatory reform. Available results from the electricity and telecommunications industries do not directly extend to the gas distribution market where, theoretically, the commodity distribution system, cost structure, market organization, and interest groups give rise to different regulations. Indeed, state commissions have adopted a heterogeneous set of policies in the gas distribution market that is different from those in other utility industries. Given the lack of literature about natural gas, this study contributes important original evidence on the ongoing wave of deregulation in the industry. To ground the empirical analysis in up-to-date knowledge, model specifications in this study are selected using lessons from existing theoretical and empirical studies from other utility industries.

[4] Among other results, length of election cycles was found to affect prices and lags in price reviews positively (Atkinson and Nowell 1994; Kwoka 2002). Campaign contributions have been found to affect telecommunications prices (Edwards and Waverman 2004; DeFigueiredo and Edwards 2005). Process of creation of consumer advocate groups affected the stringency of the regulator's price setting and cost review (Holburn and Spiller 2002; Holburn and Vanden Bergh 2006).

3. Empirical approach

The empirical analysis herein is loosely based on a theoretical model of rational regulatory choice, following Peltzman's (1976) capture model. At the center of the regulatory process is a regulator who, in every time period, chooses a regulatory regime P for each regulated utility, with the objective to maximize his long-term political return $W(P)$:

$$W\left(P_{ijt}\right)= f\left(P_{ijt}, X_{ijt}\right)+\delta \cdot W\left(P_{ijt+1}, X_{ijt+1} \mid P_{ijt}\right) \qquad [1]$$

In this expression, subscript i is for the regulator, j for the utility under consideration, and t for the current time period. P_{ijt} is a categorical policy variable whose Π_{ijt} possible realizations include the decision to retain status quo. The set of currently feasible policy choices, Π_{ijt}, may depend on the policy choice inherited from $t-1$, P_{ijt-1}. The regulator's long-term political return depends on the public support for a policy (or endorsement from relevant interest groups) in the present year, $f(P_{ijt})$, as well as the discounted political returns in future years. Policy choice in t, P_{ijt}, may affect political returns in the future by affecting the regulator's probability of remaining in his position until $t+1$, and by affecting the set of feasible policy choices in $t+1$.

The regulator's short-term political return $f(P_{ijt}, X_{ijt})$ depends on the net benefit that relevant interest groups expect to receive from a particular policy, and on the support that the regulator can receive from them in the current year (or admissibility of their endorsement, or salience of the regulator's need to be responsive to them). Expected benefits from alternative policies are thought to depend on current economic conditions in the state and at the utility. For instance, direct benefits from a policy reform may depend on the change in stakeholders' earnings (e.g., from off-system sales) or savings (from lower prices under price caps or under competition) anticipated if a new regime is adopted, including any direct costs of adoption. The size of these net benefits depends on the characteristics of the utility and of the gas distribution market in the state.

Admissibility of endorsement by interest groups, for the purpose of our analysis, is thought to depend on the regulator's reliance on support from relevant interest groups for survival until the next time period. This may vary between election and non-election years, according to the rules of commissioner re-election, or according to the number of commissioners currently seeking re-election. X_{ijt} is thus a set of economic and political factors that affect the expected benefits of alternative forms of deregulation, and the relevance of these flows to the regulator's objective.

The regulator's problem is of course dynamic. Net benefits expected by stakeholders, rules of admissibility of stakeholders' support, and the set of policy choices may change over time. Flows of net benefits, costs of policy adoption, or perhaps even stakeholders' outlays on endorsement of a policy occur at different points in time, with different certainty. Regulatory lags, and adaption or learning effects may yield delays between the times of regulatory decision, actual deregulation, and realization of benefits. Such considerations affect the regulator's political return from undertaking policy reform in a particular year.

The policy chosen at a specific regulator-utility pair in a year can thus be written as a function of the contributing economic factors at the level of the utility or state, and political factors at the state level, conditional on the prior state of regulation. These factors may be constant or time-varying.

$$\arg\max_{P_{ijt}} W = g\left(economicbenefits_{ijt}, regulatorselectionoccurrence_{it}, selectionmethod_i \mid P_{ijt-1}\right) \quad [2]$$

3.1 Estimable model

One way to identify factors affecting the regulator's political returns and regulatory decision is to study the revealed choice of regulation at each regulator-utility pair in each time period. Probability of adoption of a particular policy π at time t may be modeled as a function of economic conditions in a state, the form of regulator i's current political returns, and characteristics of utilities j: $Prob(\pi_{ijt})=f(X_{ijt})$. X_{ijt} may include economic and political factors varying across states and utilities, and over time.[5]

Several predictions suggested by existing theory and literature can be evaluated using available data. The first prediction originating in the capture theory is that the number of elections or reelections to the commission in a given year affects the joint will in the commission to commit to regulatory reform ahead of the elections (Smart 1994).

The second prediction is that the length of election cycles affects the frequency with which regulators collect political returns on their regulatory efforts, and the salience of their need to exert effort (Atkinson and Nowell 1994; Kwoka 2002; Leaver 2009). To the extent that deregulation requires commissioners' effort, and most state commissions are appointed by state legislatures, we may expect that policies in the interest of state legislature will be adopted in states with shorter commissioner terms, in years ahead of numerous reappointments. Length of election cycles may also affect regulatory choice when the process of deregulation takes several years and the outcome of regulatory efforts – their present costs and future benefits – may or may not become realized by the next election year. Policies that facilitate immediate reelection – those that are popular from the outset with voters or with legislature – may be favored when election cycles are short.

[5] Ideally, the model would also account for the characteristics of individual interest groups g with a stake in utilities j (X_{ijt}). Unfortunately, information on individual interest groups is not available systematically for all utilities and years, and so this layer is omitted from the analysis.

The third prediction is that the process of selecting commissioners influences the form of deregulation. Whether the selection is through appointment by state legislature or through public election affects regulators' political returns from each regulatory option. The direction of this effect is *a priori* unclear, because we don't observe the utility functions or political persuasions of all stakeholders, or their expectations in a particular instance of deregulation. The public-interest and the capture theories of regulation would yield different predictions regarding the effect of the regulator-selection process on policy reform. Existing empirical evidence has been inconclusive, as Section 2 has reported.

The fourth prediction is that political-party composition of commissions affects the political goals that commissions seek through regulatory decisions. Democratic leaning of the commission or state legislature may promote policies in the interest of core consumers (Campbell 1996). Finally, the fifth prediction we may test is that commission size affects positively quality of decision-making at the commission, and may allow for more complex forms of deregulation (Berry 1979) or deregulation less derailed by special interests (Kwoka 2002). These hypotheses may be jointly represented in the following way, testable by a regression:

$$Prob(\pi_{ijt}) = g\begin{pmatrix} regulatorselectionoccurrence_{it}, \; selectioncycle_{i}, \; selectionmethod_{i}, \\ commissioncomposition_{it}, \; commissionsize_{i} \end{pmatrix} + \varepsilon_{ijt} \quad [3]$$

To sort among the deregulatory programs evaluated in this study, previous literature has worked with the generalization that restructuring favors consumers, particularly core consumers, whose prices may fall due to competitive pressures, demonstration effects from other utilities, and diminution in cross-subsidization. Sliding scale plans and price caps have been viewed as favoring utilities, whom they give opportunities to earn above-normal returns. The above predictions could then be interpreted as follows. Shorter commissioner terms are predicted to expedite any form of deregulation. It is unclear whether they would favor restructuring – which works for consumers and benevolent legislators – or price caps and sliding scale plans – whose outcomes can be evaluated swiftly. The effects of the timing of elections and commissioner selection process are also unclear. In any case, finding that elections are empirically irrelevant to policy choice would lend support to the public interest theory of regulation. Next, we may predict that Democratically leaning commissions and legislatures, advocating core consumers, will choose restructuring rather than other deregulatory programs or the status quo. Commissions with more members may have more resources to undertake successful restructuring or, being less susceptible to special interest lobbies, may be more inclined to retain rate of return regulation.[6]

In an attempt to isolate causal effects of political factors, and to interpret estimated coefficients with any sense of confidence, economic determinants of policy reform will be controlled for (Hlasny 2011a). In addition, the set of regulator-utility pairs will be restricted to those with similar preexisting policy regimes. Decisions about alternative policies will be studied jointly, since regulators have a number of deregulatory options from which to choose, and the decision to adopt a particular policy affects decisions about other policies. This study employs a novel type of analysis, the Cox competing-risk hazard regression, to study the time-varying risks of adoption of three alternative deregulatory regimes. This method is suitable for this problem, as it identifies variations in the risk of deregulation across regulator-utility pairs, years, as well as modes of deregulation.

3.2 Cox model of time to deregulation

[6] One may formulate other hypotheses of interest beside those above. However, many hypotheses cannot be tested using currently available data. In particular, information on direct pressure by various interest groups, on the will and revolving-door aspirations of individual commissioners, and on provisions of individual deregulatory programs is not available reliably and systematically for all states and years, or may change over time even *ex post*, and thus cannot be used here.

The Cox model is used to predict the hazard of deregulation of utilities that have not deregulated yet, using information on the timing of deregulation at presently deregulated utilities. The standard model is advanced to allow for competing risks of adoption of alternative deregulatory plans.

Hazard of an event is the probability that the event occurs in a time period, conditional on the fact that it has not occurred until then. Hazard of adoption of a program π at each regulator-utility pair ij in year t, $\lambda_{ij\pi t}$, is frequently modeled as an exponential function of determining factors, multiplied by an estimated baseline time-varying hazard rate of adoption: $\lambda_{ij\pi t} = \exp(\gamma_\pi \cdot X_{ijt}) \cdot \lambda_{00\pi t}$. In this expression, X_{ijt} is a vector of time-varying explanatory variables specific to each regulator-utility pair ij and γ_π is the associated vector of coefficients specific to policy π. $\lambda_{00\pi t}$ is a duration-dependence baseline hazard of policy π as of time t – the hazard of adopting π conditional on all control variables being set to zero, independent of the regulator's or the utility's characteristics.[7]

3.3 Data

Data for this analysis come from several public sources, most importantly the Department of Energy, National Association of Regulatory Utility Commissioners, and webpages of state public service commissions. Information on the form of regulation comes from a custom survey of state public service commissions conducted three times between 2001 and 2007 (Hlasny 2006, 2008a). The data cover all utilities in the continental US reporting on the Department of Energy's EIA-176 form during 1996-2004. The sample includes 12,941 observations (2,222 utilities), of whom 9,640 observations (1,535 utilities) have all explanatory variables available. Table 2 reports the

[7] To allow for ties in the time to deregulation across regulator-utility pairs, the Breslow estimator of the cumulative baseline hazards is used.

source and description of each variable. Table 3 describes the presence of deregulatory programs in the sample, including their joint distribution.

Variable	Data Source	Units in Model	Mean	St.Dev.
Election cycle length	Beecher (2010)	Years	5.198	1.055
Ratio of commissioners selected in *t-1*	Beecher (2007), NARUC (2010), PSC websites	Newly selected / all commissioners (%/100)	0.250	0.267
Commissioners appointed vs. elected	Beecher (2010)	Binary for appointed	0.720	0.449
Democrats in commission in *t-1*	Beecher (2007), NARUC (2010), PSC websites	Count, Democrats minus Republicans	-0.344	2.878
Democrats in state senate in *t-1*	National Conference of State Legislatures	Democratic / all legislators (%/100)	0.518	0.129
Commission members	Beecher (2010)	Count	4.083	1.171
Sliding-scale programs used in state electricity industry (*t-1*)	Myers & Strain (2000), Survey of PSCs	Binary	0.320	0.466
Price caps used in state electric industry (*t-1*)	Myers & Strain (2000), Survey of PSCs	Binary	0.363	0.481
Price caps used in state telecom ind. (*t-1*)	Myers & Strain (2000), Sappington (2002), Survey of PSCs	Binary	0.545	0.498
Sliding-scale programs in gas ind. in surrounding states (*t-1*)[a]	Survey of PSCs	$\text{Count}^{0.5}$	1.716	1.033
Price caps in gas ind. in surrounding states (*t-1*)	Survey of PSCs	$\text{Count}^{0.5}$	0.513	0.583
Consumer-choice programs in gas ind. in surrounding states (*t-1*)	DOE, EnergySource	$\text{Count}^{0.5}$	0.159	0.411
Residential price of gas at utility in *t-1*	DOE, Form EIA-176	10% change in ($/Mcf)	0.000	4.864
Volume of gas sold at utility in *t-1*	DOE, Form EIA-176	10% change in Mcf sold	0.000	2.547
Herfindahl-Hirschman Index of gas utilities in state in *t-1*	Form EIA-176	10%-points	2.791	1.693
State per-capita income in *t-1*	US Bur. Econ. Analysis	10% change	-1.332	1.211
State unemployment rate in *t-1*	US Bur. Econ. Analysis	1%-point	4.848	1.029
State business income tax rate in *t-1*	Federation of Tax Administrators	1%-point of lower bound on corp. income tax	-0.558	1.877

[a] Surrounding states are identified as states in the same U.S. Census geographic division as the reference state. The divisions are: Pacific (CA, OR, WA), Mountain (AZ, CO, ID, MT, NV, NM, UT, WY), East North Central (IL, IN, MI, OH, WI), Mid-Atlantic (PA, NJ, NY), South Atlantic (WV, DC, DE, FL, GA, MD, NC, SC, VA), East South Central (AL, KY, MS, TN), Northeast (CT, MA, ME, NH, RI, VT), West North Central (IA, KS, MN, MO, NE, ND, SD), West South Central (AR, LA, OK, TX).

Table 2: Description and Source of Explanatory Variables

In the analysis, length of election cycle, number of commissioner positions open for appointment and the process of selecting new commissioners control for commissions' reelection motives. Party composition of commissions and state legislatures, and commission size control for the regulatory environment in which commissions make their decisions. Commission size may proxy for 'professionalism' of commissions (Berry 1979), for the system of checks and balances in place, or for the ease of reaching a consensus within commissions. Controlling for commissions' experience with deregulation is the count of deregulatory programs implemented in the gas market in surrounding states, and the implementation of deregulatory programs in other utility industries within the state. Square root of the count of programs in surrounding states is used to emulate parsimoniously diminishing returns to demonstration.[8]

Residential prices of gas, volume of gas sold, and operation type (pipeline, gas storage, other) control for time-varying characteristics and performance at the level of utilities. Herfindahl-Hirschman Index (HHI) for the concentration of utilities in the state gas distribution market measures inversely the amount of interaction among utilities and strength of competitive forces in the industry.[9] State per capita income, unemployment rate and business income tax rate proxy for the fiscal environment in the state, including regulatory priorities and consumers' ability to pay. Additional variables were considered for the analysis, but were eventually omitted out of concern for degrees of freedom and for lack of empirical significance. This includes: utilities' small-commercial and industrial prices of gas, portion of state natural-gas revenues coming from respective consumer classes, business establishments per capita, number of underground gas

[8] The fact that individual states have a different number of neighbors does not represent a conceptual problem. Commissions that interact with more numerous neighbors are fully expected to be influenced more and to respond more to regulatory experience out of state. Controlling for state size explicitly also turns out not to change any relevant results substantially.

[9] State is chosen as the definition of utilities' market out of conviction that concentration within a state represents closely the effective amount of competition that a utility faces, and for a lack of better measures. State boundaries provide some effective restriction on utilities' operations (e.g., requirements to be licensed in a state to compete there, and to deal with transmission companies in a state), and so the HHI in the state market is expected to be a better measure of the effective interaction among utilities regardless of state size than, say, a uniform-size market definition. Controlling for state size explicitly does not affect results in Table 4 qualitatively.

storages, price of electricity and coal, personal and small-business income tax rates, and bankruptcy rates.

To allow for a lag in regulatory response to political and economic conditions, and to avoid feedback from deregulation to explanatory variables, all explanatory variables are in their first-lag form. Deregulation in 1997 is thus linked to conditions in 1996. Other distributed lags of explanatory variables were considered, but the first lag was kept as the most theoretically justified, parsimonious, and empirically significant. For simplicity of presentation, the next section overlooks the allowed one-year regulatory lag, and refers to the estimated coefficients as the effects of explanatory variables on the *current* risk of deregulation.

Program	**States**	**Utilities**	**Observations**
Consumer choice–pilot or implemented[a]	22	216	721
Price cap[b]	4	7	20
Sliding scale plan[ab]	21	37	134
Sample size	47	659	3,646

The reported number of states, utilities and observations have information on years prior to deregulation, needed for the analysis. Programs implemented before or in 1996 are dropped.
[a] Of these numbers, 10 states, 16 utilities and 29 observations have both consumer choice programs and sliding scale plans.
[b] Of these numbers, 2 states, 4 utilities and 8 observations have both price caps and sliding scale plans.

Table 3. Inventory of Policies in the Sample

One limitation of the available data is that regulatory regime at utilities is measured imprecisely. Policies are measured by binary indicators for the adoption of the policies at a utility, regardless of the detailed provisions of the policies. This is a limitation to the extent that the same policies may vary across utilities by their incentive power, number of affected customer classes, number of customers, agreed upon time span and other factors. Utilities with the same policy are thus implicitly assumed to be regulated subject to similar gas procurement, pricing, cost recovery and rate-of-return rules. In reality, policy with a greater incentive power, extent and time span may be more difficult to implement. However, the detailed provisions are difficult to observe, or are renegotiated over time even *ex post*. Moreover, inclusion of these shades of regulation would render the empirical model difficult to estimate. The degrees of freedom would fall with the rising number of categories of regulatory outcomes, because each policy alternative requires estimation of another set of coefficients and another baseline hazard.

For empirical reasons, earnings-sharing, margin-sharing and gas-cost incentive plans are evaluated jointly in this study as sliding-scale programs. One reason is that some of these programs have been adopted very rarely in reality. In the analysis, even fewer occurrences may exist if some independent variables are missing for a utility with the program. With a small portion of the sample under policy treatment, the estimated coefficients would be imprecise. The second reason is that the degrees of freedom in the analysis falls with the number of alternative policies. Making different sliding-scale plans interchangeable with each other is acceptable, provided they are similar in their adoption process. This is plausible, because commissions often adopt more than one sliding-scale plan at the same time, and the main economic implications – profit-sharing rates, and absolute volumes transferred – are similar across the plans.[10]

Table 3 indicates that multiple policies have been implemented at a small fraction of utilities and observations. For the purpose of performing competing-risk hazard analysis, and of preserving sample variation for mechanisms that are implemented rarely, observations with sliding scale plans and price caps (8 observations) will be coded as having price caps only, and observations with sliding scale plans and consumer choice programs (29 observations) will be coded as having sliding scale plans only. Such arbitrary coding on a small subset of records is

[10] To empirically evaluate the sensitivity of the results to the simplifying assumptions, policy choices may be modeled using other assumptions. Repeatable-events hazard models may attempt to distinguish various sliding-scale plans, and various stages of restructuring: consumer-choice programs considered, piloted, partially implemented and fully implemented. Results of these models would be sensitive to the accuracy of data on all policies, and to the number of observations for each policy category. Specification used in this study is far more robust to these issues.

arguably still more sensible than performing a less robust analysis – with more types of policy outcomes – or omitting those records entirely.[11]

4. Results

Table 4 reports the results of the Cox hazard model introduced above, estimated with two different sets of control variables. The left three columns in Table 4 make the risk of deregulation a simple function of political factors at the state level. The latter three columns add controls for regulatory experience from other industries, characteristics of individual utilities and state economic conditions, to identify more accurately the partial effects of political variables. Comparing the simple political model (left three columns) and the combined political and economic model of deregulation (right three columns) indicates that the estimated effects of political factors are qualitatively similar, particularly for restructuring and sliding scale plans, but change quantitatively and become more significant when economic and demonstration effects are controlled for. The overall fit of the regression also improves substantially.

Hazards estimated in Table 4 account for the fact that three alternative deregulatory policies compete for adoption simultaneously. The reported coefficients can be interpreted as contributions of a one-unit change in the variables to the risk of adopting a particular policy relative to the risk of retaining benchmark rate-or-return regulation.[12]

[11] By essentially resetting some consumer-choice (and sliding-scale) programs to zero, this coding is thought to affect mostly coefficients in consumer-choice (and to a lesser degree sliding-scale) regressions. Because of the large prevalence of these programs in the sample, however, the effects are expected to be small. Indeed, if we treat the utilities with two coexisting policies (29+8 observations) as pairs of utilities with one policy each (74 observations), we get very similar results to those in Table 4.

[12] Before estimating the competing-risks regressions in Table 4, the alternative deregulatory programs were evaluated individually, using policy-specific hazard regressions (available on request). An important limitation of the policy-specific regressions is that they treat alternative policies as equivalent to the status quo. In the study of implementation of, say, restructuring, utilities adopting price caps or sliding-scale plans were treated as non-deregulated, and their observations as right-censored. The first issue here is that the incentive to adopt restructuring may be different depending on whether the utility has been operating under rate of return, price-cap, or sliding-scale

The first six rows in Table 4 report on the influence of political factors. The more frequently commissioner seats are assigned in a state – because of shorter election cycles – the higher the risk of all forms of deregulation, particularly of price caps and consumer choice. A decrease in commissioner terms by one year is estimated to increase the risk of adoption of price caps by 807%, and that of restructuring by 44%. The number of commissioner seats open for assignment in a year is positively related to the risk of deregulation via price caps, and negatively related to the risk of other forms of deregulation. When an additional 20% of commissioner seats are up for reassignment (say, one out of five commissioner seats is up for reelection), the risk of price caps rises by 48% (2.382*100*20%) and that of restructuring falls by 34%. It appears that deregulation via sliding-scale and consumer choice programs is more difficult (statistically significantly for consumer choice) than adoption of price caps or retention of status quo in election years.[13] This could be due to political or technical reasons. Bringing about effective restructuring can take several years.

Similarly, the process of commissioner selection appears systematically related to the type of regulatory reform, with appointments by state legislature increasing the risk of restructuring by 153% (significant), and public elections decreasing the risk of price caps by 203%. In sum, the scope of commissioner selections in a year, and the involvement of general public in them tend to favor price caps over other possible deregulatory regimes or the status quo. Restructuring tends to be adopted later, in non-election years, and particularly in states where commissioners are appointed by state legislators. Possible interpretations of these results are that voters favor

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regulation. In addition, a low estimated risk of restructuring should not be interpreted as a high risk of retention of rate of return. One must remember what policy outcomes are contained and most prevalent in the benchmark when interpreting the coefficients. For these reasons, competing-risks estimation is more appropriate.

[13] The number of *successful reelections or reappointments* of commissioners was also evaluated, but was omitted as less significant. This variable also suffers from measurement issues and a likely feedback from the dependent variable.

price caps; restructuring takes too long to be finalized (or even attempted) in election years; or public elections are susceptible to influence of special interests from the industry or from labor unions. These groups may prefer utility-level deregulation (price caps) to restructuring or to the status quo. When public sentiment or campaign support from interest groups is needed in commissioner selection, state commissioners may push through price caps, against other deregulatory options or against the benchmark rate-of-return regulation.

	Sliding scale	**Price cap**	**Choice**	**Sliding scale**	**Price cap**	**Choice**
Election cycle	-0.198	-0.303	-0.726***	-0.283	-8.071***	-0.438***
length	(0.305)	(0.372)	(0.061)	(0.316)	(2.067)	(0.108)
Commissioners	-0.302	0.902	-1.478***	-1.629	2.382*	-1.675***
selected in *t*	(0.637)	(0.852)	(0.135)	(1.132)	(1.376)	(0.143)
Appointed	0.939*	0.439	1.838***	-0.005	-2.027	1.533***
v. elected	(0.539)	(0.514)	(0.190)	(0.712)	(2.247)	(0.375)
Democrats	0.133*	0.153	-0.057***	0.175	1.881***	-0.023
in commission	(0.077)	(0.130)	(0.021)	(0.116)	(0.372)	(0.030)
Democrats	0.86	1.091	2.950***	2.1*	34.467***	-0.719
in state senate	(1.451)	(1.395)	(0.472)	(2.045)	(6.876)	(0.875)
Commission	-0.388	-0.724	0.702***	-0.179	-1.085*	0.811***
members	(0.281)	(0.552)	(0.051)	(0.349)	(0.660)	(0.093)
Sliding scale plans				-1.661***		0.758***
in electr. industry				(0.599)		(0.227)
Price caps					5.222**	-0.548***
in electr. industry					(2.275)	(0.164)
Price caps					4.805**	-2.633***
in telecom industry					(2.114)	(0.237)
Sliding scale plans in				-0.215		0.432***
gas industr. in region				(0.259)		(0.067)
Price caps in					-2.245***	-0.658***
gas industr. in region					(0.495)	(0.127)
Choice programs in						-2.439***
gas industr. in region						(0.292)
Price of gas				0.013***	0.115***	-0.062***
				(0.004)	(0.024)	(0.015)
Utility volume				0.008***	0.062***	0.002
				(0.002)	(0.013)	(0.001)
Herfindahl				0.012	1.994***	-0.046
-Hirschmann Index				(0.213)	(0.307)	(0.075)
Pers. income				0.265	-0.38	-0.681***
				(0.269)	(0.395)	(0.114)
Unemployment rate				-1.233***	-1.799***	-0.419***
				(0.248)	(0.381)	(0.081)
Business income tax				-0.538	-2.317	1.666***
				(1.232)	(1.578)	(0.365)
Observations (Utilities) [States]		9,640 (1,535) [47]			8,873 (1,372) [47]	

Log pseudo-likelihood	-4,276.44	-3,403.40
Wald Chi-square	896.07	3,427.18

* statistically significant at 10%; ** 5%; *** 1%, two-sided tests. Standard errors, in parentheses, are corrected for heteroskedasticity and autocorrelation at the utility level. Monetary terms are in 1996$. Price and volume of gas sold are at the utility level. Type of operation of utilities, state price of electricity and electric generators' price of coal are controlled for in the economic model. Number of programs in region excludes program at that utility. Commission and legislature data, programs in other industries, fuel prices, income, unemployment, income tax and Herfindahl-Hirschman Index are at the state level. The number of records used in estimation is technically 28,920 (9,640 for each of the 3 types of deregulation) and 26,619 (8,873*3), respectively.

Table 4. Competing-Risks Cox Hazard Model Results

The next two rows report on the effects of political-party composition of state commissions and state legislatures. Democratic leaning of the commission and of state legislature tends to favor deregulation via price cap (or, insignificantly, sliding-scale plans), and hinder restructuring. When a Democratic commissioner replaces a Republican one, the risk of price cap regulation increases by nearly 400% (1.88*2). A 10% increase in Democrats' representation in state senate is associated with a 345% increase in the risk of price cap regulation. This may be interpreted the same way as the role of public elections – Democratic candidates may be more receptive to the needs of core consumers, or may succumb to pressure from union lobby. If voters and organized workers prefer price caps over the status quo or other deregulatory regimes, Democratic candidates may pursue that form of deregulation. This may also correspond to the common perceptions of the parties' attitudes toward competition in the marketplace and toward economic governance. Republican legislatures tend to promote competition, while Democrats prefer controlled, utility-level deregulation, perhaps as they doubt the prospect of effective competition.[14]

[14] To test whether the political composition of state legislature matters only when commissioners are appointed by this legislature, an interaction term of Democrats-in-senate and Appointed was also considered. This interaction term had a positive effect in the price-cap and sliding-scale regressions (significant in price-cap regression), and zero effect in the consumer-choice regression. Other coefficients and standard errors were essentially unaffected, except for the price-cap regression, where many coefficients gained in absolute size and significance – affirmation of low (and diminished) degrees of freedom.

The next row reports that restructuring tends to be adopted by commissions that have more members, while price cap and sliding-scale plans are adopted by smaller commissions. An increase in commission size by one member is associated with a 109% decrease in the risk of price caps, and an 81% increase in the risk of restructuring. This may be an artifact of the complexity inherent in bringing about full-blown restructuring, and of other facets of the decision-making process behind regulatory reform. Larger commissions may also be less prone to influence from special interests (Kwoka 2002).

The following six rows in Table 4 show that policies adopted in other utility industries in the state, and in the gas industry in surrounding states are related to the risk of adoption of the same policy at a gas utility. Prevalence of sliding scale plans in the electricity industry in the state is associated negatively with the risk of this form of deregulation in the gas industry (a fall by 166%), and positively with the risk of restructuring (a 76% increase). The most plausible explanation for these unexpected results is that sliding-scale programs may serve as forerunners of full restructuring. Observing them in a state in one year may lead us to expect restructuring in the coming years.[15] Prevalence of price caps in other utility industries in the state – both electricity and telecommunications – has the expected positive effect. It increases the risk of price cap regulation in the gas industry by roughly 500%, and decreases hazard of restructuring also substantially.

Deregulation in the gas industry in surrounding states has unexpected effects on deregulation in states: experience with restructuring (sliding-scale plans or price caps, respectively) in surrounding states lowers the risk of restructuring (sliding-scale or price-cap adoption,

[15] Other possible explanations are: 1) negative demonstration effects – negative experience with sliding scale plans at electric utilities; 2) constraints on regulators' resources – ability to offer particular incentives only in one industry at a time. Sliding-scale plans in the electricity industry, as well as sliding-scale and consumer-choice programs implemented in other states are omitted from the price-cap regression to preserve the degrees of freedom.

respectively) in states. This is significant for price caps and restructuring. On their face value, these results would imply that the experience with deregulation in U.S. states discourages deregulation in surrounding states. While policy reforms have not been successful in all states where they were undertaken, the experience has been positive overall, as the rising number of deregulatory programs confirms. These unexpected results are difficult to explain.

The two expected results here are that the prevalence of sliding-scale plans across states raises the risk of restructuring in surrounding states, and the prevalence of price caps reduces it. There appears a strong negative relationship between the usage of price caps, and of consumer choice programs across utility industries in a state, and across U.S. regions. There also appears to be a positive relationship between the adoption of sliding-scale plans and consumer choice programs. Sliding-scale programs appear to have similar criteria for adoption as restructuring, while the criteria for price caps are contrary. The systematic negative association between price caps on the one hand, and restructuring and sliding-scale regulation on the other hand may be caused by the practice to implement price caps to avoid full-blown restructuring, and the adoption of sliding scale plans as a preparatory step for successful restructuring.

The next two rows in table 4 show coefficients on utility-level economic variables. Residential price of gas is associated positively with the risk of sliding scale plans and price caps, and negatively with the risk of consumer choice. If a utility charges 10% higher prices than other utilities, its risk of deregulation is 1.3% higher for sliding scale plans and 11.5% higher for price caps, while its risk of restructuring is 6.2% lower than at other utilities. These price effects are quite small, but their signs correspond to those in previous studies (Primeaux *et al.* 1984; Hlasny 2011a,b). Together they may imply that utilities that are less efficient or exercise some market power – in the sense of charging higher regulated prices than their peers or than in previous time periods – tend to be assigned incentive regulation tailored to the particular utilities: price caps or sliding scale plans. Regulators may hope to change utilities' performance under new utility-level payoff regimes, a public interest motive. Another interpretation is that only utilities that appear most efficient or most likely to fare well under competition are allowed to undergo restructuring.

Utility's capacity is related positively to the risk of deregulation via sliding scale plans and price caps, and has no bearing on the prospect of restructuring. 10% larger utilities are 0.8% (6.2%) more likely to be assigned a price cap (sliding-scale plan, respectively), a small effect. This may imply that the amount of resources and experience a utility has – and perhaps even its perceived market power (even while holding market concentration fixed), or ability to lobby regulators, or absolute level of benefits to ratepayers – raises the expected success of utility-level deregulation. Such factors are less important to facilitating competition under restructuring.

The last four rows show the estimated effects of state-level economic controls. HHI for the state gas distribution market is related positively to the risk of price caps (significantly) and sliding scale plans, and negatively to that of restructuring. HHI greater by ten percentage points is associated with a 200% increase in the risk of price caps, and a 4.6% decrease in the risk of restructuring. Once again, market power appears to favor deregulation at the utility level, particularly price caps, which can dampen utilities' ability to charge monopoly prices. Market power may also signal that local market is not ready for competition or restructuring.[16]

Higher per capita incomes in a state are associated with a lower risk of restructuring, statistically significantly, and a higher risk of sliding-scale plans and price caps, in theoretical agreement with Primeaux *et al.* (1984). A 10% increase in personal incomes is associated with a 68% decrease in the risk of restructuring. Unemployment rate is associated negatively with

[16] State size and number of neighboring states were evaluated in supplementary regressions to verify that the estimated effects of HHI, commission size, utility size, and demonstration effects from neighboring states cannot be attributed to geographic differences.

deregulation, with every additional percentage point of unemployment being associated with a 42-180% decrease in the risk of any form of deregulation. This may imply that under poor macroeconomic conditions, state governments and their appointed (or elected) commissioners have other priorities than deregulation of utilities. Variation in corporate income tax rates across states is related positively (significantly) to the risk of restructuring, and negatively to the risk of other forms of deregulation. Taken together, these patterns are difficult to interpret, and probably correspond to the effects of unobserved fiscal conditions across states and over time, or to incidental correlations among variables. Since this study is concerned with political determinants of regulatory reform, controlling for these fiscal effects is still warranted, as it allows us to distill the partial effects of political factors.

There is one potential pitfall of the models presented in Table 4 that should be mentioned. The competing-risk hazard model relied on the assumption of proportional hazards – hazard of adoption of a policy should be independent of the choice set of available deregulatory programs. For any two utilities, the ratio of the estimated hazards should remain constant regardless what other plans are available. Kaplan-Meier observed and predicted survival curves can help evaluate this assumption. The closer the observed values are to the predicted values, the less likely the proportional hazards assumption has been violated. The predicted curves are very close to the observed values, thus alleviating fears that the important assumption was violated. Kaplan-Meier log-log survival curves of individual policies against log-time confirm this. The proportional-hazards assumption appears to be valid, because the curves are nearly perfectly parallel.[17]

[17] Both figures are available on request. To further verify reasonableness of the proportional-hazards assumption, results of the joint competing-risks model in Table 4 were compared against a model stratified by policy alternatives or by distinct time periods. Since restructuring became a viable policy option only in year 1999 (after the initial pilot programs proved feasible, and upon support from federal legislation), periods 1996-1998 and 1999-2004 are distinct in the effective menu of available policies, and can be used for stratification. (The experience with restructuring in California and Georgia became known only in the second time period. Delaware and Wisconsin also discontinued their pilot programs in the second time period.)

As a robustness check, to avoid potential bias due to time-constant heterogeneity across U.S. geographic divisions or individual states, fixed effects varying by region and deregulation type were added. Results of this analysis are reported in the Appendix. The first three columns report on the model with fixed effects varying by U.S. geographic division and deregulation type (27 fixed effects). These results differ somewhat from those in Table 4, but the main qualitative results still hold. A small number of coefficients change sign, particularly in equations for price caps and sliding scale plans. Many coefficients increase in magnitude, an indication of over-parameterization or multicollinearity (whereas the variance-covariance matrix is near singular). These findings presumably derive from incidental correlations between the adopted programs or control variables and some of the fixed effects. The last three columns report on the model with fixed effects varying by state and deregulation type (147 fixed effects). Many coefficients in this model are extremely large in absolute value, and of spurious sign and significance. Some standard errors, especially in the regression of price caps, cannot be computed, implying insufficient degrees of freedom.

Because of the small number of program adoptions in the sample, and the large number of region-type indicators, fixed-effects estimation has resulted in over-parameterization, the chasing of too few adoptions by too many variables. This was a minor issue in a model with fixed effects at the level of U.S. regions, but a major issue in a model with state-level fixed effects, because the occurrence of price caps and sliding-scale plans is very rare in most states. Rather than concluding that the main results in table 4 are systematically biased, we should interpret these supplementary findings as highlighting degrees-of-freedom issues.[18]

[18] As yet another robustness check, the analysis in Table 4 was repeated using only large utilities, to limit heterogeneity of utilities in the sample. The rationale was that smallest utilities are regulated differently than medium-size and large utilities, and have other systematic differences that cannot be controlled for. In fact, all price caps and sliding scale plans in our sample occur at large utilities. In this analysis, three-quarters of utilities with the

5. Conclusions

This study has evaluated several political factors thought to have bearing on regulatory reform in the gas distribution market. Three deregulatory regimes – sliding-scale incentive regulation, price cap regulation, and restructuring with consumer choice – were studied jointly in a competing-risk hazard model, to account for the fact that regulators have various deregulatory options from which to choose, and the decision to adopt one policy affects decisions about other policies. The system of selection of state commissioners, frequency and timing of elections, and composition of commissions and state legislatures were evaluated, as determinants of commissioners' reelection motives. Selected economic and demonstration effects at utility and state levels were controlled for.

The results indicate that the process of selecting state commissioners is an important determinant of regulatory outcomes at gas utilities. Shorter commissioner term limits are conducive to all forms of deregulation, although it is unclear which form of deregulation they promote most, and the timing of deregulation varies by deregulation type. Chances of adopting price caps are higher in election years, while those of restructuring are lower immediately but rise later. Perhaps in agreement, public elections of commissioners appear to favor price caps, while appointments by state legislature – without voters' immediate input – appear to favor restructuring.

Political-party composition of state commissions and state legislatures contributes. Democratically leaning commissions and state legislatures appear to favor adoption of price caps, and shun restructuring. Possible explanations of the positive effects of elections and Democratic

smallest capacity were dropped, reducing the sample size to 659 utilities (3,646 observations). Results, reported in Table A2 in the Appendix, are qualitatively very similar to the main results for the overall sample.

affiliation on price caps, and the negative effects on restructuring are that households expect to benefit from price caps, or that it takes a long time to implement restructuring and observe its benefits. Publicly elected commissioners may shy away from restructuring, or their election-year efforts may come to fruition only in later years. Democratic legislatures may also place less trust in competitive market forces, which are necessary for restructuring to succeed. Smaller commissions also appear to shy away from restructuring, perhaps because of its complexity, or because of the influence of special interests on commissioners in smaller commissions.

In sum, several findings in this study are in line with the assertions in ‘regulatory capture’ literature: the method of appointment of commissioners influences commissioners’ objectives; imminence of public elections affects the salience that commissioners attribute to policy reform; and commissioners’ political persuasion affects their mode of regulation. A number of robustness checks support these findings, including analysis disintegrated by deregulation type, estimation with fixed effects, and sample re-definition.

Among other findings, utilities’ prices and size, and market concentration contribute in expected ways to explaining the outcome and timing of regulatory reform. Utilities’ prices, size and market concentration are associated positively with the risk of price caps and sliding-scale plans, negatively or insignificantly with restructuring. The estimated effect of utilities’ size may imply that the utilities’ resources and experience – and perhaps even the effective or perceived market power, or ability to lobby regulators, or absolute level of benefits to ratepayers – signal to regulators the expected success of utility-level deregulation. These same factors are unimportant or counterproductive to facilitating competition under restructuring. Prices and market concentration have similar bearing on deregulatory efforts. These results can be viewed as supporting the ‘public interest,’ or correction of market failures, explanations of regulatory reform.

Thus, it appears that both valid economic motives and personal capture motives help to explain the pattern of regulation of gas distribution across U.S. states and over time. It would be tempting to compare the relative importance of ‘regulatory capture’ versus ‘public interest’ factors at bringing about regulatory change, but unfortunately their effects cannot be easily separated. Both types of motives may operate through the same observable economic variables (such as market power), in the same or opposite direction, with different magnitude across control variables, deregulatory options, and jurisdictions. The observed regulatory decisions are the result of the tug of war between public interest and commissioner reelection motives.

Finally, a word of caution regarding inference from the results reported above. While this study has controlled for a number of economic and demonstration effects to identify the individual contribution of political variables, many other variables were omitted, for lack of systematic data or for fear of over-parameterization. The equations estimating the hazard of price caps and sliding scale plans were particularly sensitive to the choice of regressors, due to the small number of observations under policy treatment. Coefficients estimated in Table 4 may not allow precise inference to other, currently non-deregulated states. As additional states deregulate their gas distribution markets in the coming years, the additional data will help to ascertain the effects estimated here, and allow for a richer analysis. Collection of reliable evidence on the influence of interest groups, and on the revolving doors between commissions and regulated firms should help.

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Appendix: Additional Results

	Sliding scale	**Price cap**	**Choice**	**Sliding scale**	**Price cap**	**Choice**
Election cycle	1.650**	-389.51***	-0.025	-20.685***	392.758***	-490.270***
length	(0.652)	(1.259)	(0.094)	(1.655)	(7.692)	(2.659)
Commissioners	-0.234	454.571	-1.896***	-2.190	80.939	-30.923***
selected in *t*	(0.981)	α	(0.329)	(1.538)	α	(4.639)
Appointed	-3.318	-853.54	1.055***	-62.948***	1,723.610	1,175.225***
v. elected	(2.413)	α	(0.288)	(13.759)	α	(12.606)
Democrats	0.03	119.180***	-0.006	0.562	68.446***	-43.270
in commission	(0.230)	(0.600)	(0.035)	(0.363)	(1.590)	(0.873)
Democrats	-3.548	2,550.33	7.106***	61.051**	107.701	-2,640.620
in state senate	(7.169)	α	(1.176)	(26.039)	α	α
Commission	-0.172	-141.018	0.027	12.127***	-108.440	-51.971***
members	(0.422)	α	(0.185)	(2.000)	α	(4.645)
Sliding scale plans	-4.741***		2.853***	-7.253**		-457.144***
in electr. industry	(1.173)		(0.278)	(3.567)		(5.443)
Price caps		-136.526	-1.756***		5.719	241.374***
in electr. industry		α	(0.520)		α	(8.305)
Price caps		249.851	-3.005***		143.887	-122.217***
in telecom industry		α	(0.383)		α	(17.683)
Sliding scale plans in	-2.207***		-0.412***	-1.398**		0.037
gas industr. in region	(0.642)		(0.070)	(0.623)		(0.025)
Price caps in		-130.744	-0.34		-60.102	-0.040
gas industr. in region		α	(0.214)		α	(0.058)
Choice programs in			-3.220***			-74.449***
gas industr. in region			(0.605)			(0.654)
Price of gas	0.024*	3.478***	-0.036***	0.047*	3.508***	-0.004
	(0.013)	(0.058)	(0.013)	(0.026)	(0.060)	(0.004)
Utility volume	0.009***	6.806***	0.001	0.012	6.866***	-0.000**
	(0.003)	(0.008)	(0.001)	(0.013)	(0.023)	(0.000)
Herfindahl	-0.849*	-275.803	0.440**	5.694	-575.176	-132.225***
-Hirschmann Index	(0.472)	α	(0.185)	(3.936)	α	(2.048)
Pers. income	-0.839*	508.460***	-1.106***	-5.900**	191.795	245.875***
	(0.435)	(1.426)	(0.150)	(2.458)	α	(2.892)
Unemployment rate	-2.035***	-190.027	-0.652***	-3.156***	-41.615***	-83.540***
	(0.323)	α	(0.098)	(0.888)	(1.659)	(1.060)
Business income tax	-2.575	-996.158	-2.301***	18.097*	-422.582	234.237***
	(2.546)	α	(0.547)	(9.753)	α	(13.708)
Fixed effects	Geographic-Divisn. × Deregulation-Type			State × Deregulation-Type		
Observations (Utilities) [States]	8,966 (1,372) [47]			8,966 (1,372) [47]		
Log pseudo-likelihood	-2,819.75			-2,331.42		

* statistically significant at 10%; ** 5%; *** 1%, two-sided tests. Standard errors, in parentheses, are corrected for

heteroskedasticity and autocorrelation at the utility level.

α Standard error cannot be computed because of insufficient degrees of freedom.

Monetary terms are in 1996$. Price and volume of gas sold are at the utility level. Type of operation of utilities, state price of electricity and electric generators' price of coal are controlled for in the economic model. Number of programs in region excludes program at that utility. Commission and legislature data, programs in other industries, fuel prices, income, unemployment, income tax and Herfindahl-Hirschman Index are at the state level. The number of records used in estimation is technically 26,898 (8,966 for each of the 3 types of deregulation).

Table A1. Results of Regressions with Regional & Deregulation-Type Fixed Effects

	Sliding scale	Price cap	Choice	Sliding scale	Price cap	Choice
Election cycle	0.018	-0.246	-0.398***	-0.249	-8.024***	-0.341***
length	(0.236)	(0.283)	(0.085)	(0.283)	(2.360)	(0.097)
Commissioners	-0.067	1.144	-0.835***	-1.601	2.372**	-1.333***
selected in *t*	(0.689)	(0.868)	(0.171)	(1.128)	(1.060)	(0.201)
Appointed	0.799	0.27	1.154***	0.158	-2.69	1.523***
v. elected	(0.550)	(0.618)	(0.268)	(0.756)	(2.398)	(0.244)
Democrats	0.182**	0.186	-0.127***	0.162	1.890***	-0.079**
in commission	(0.081)	(0.157)	(0.031)	(0.120)	(0.441)	(0.035)
Democrats	-0.76	0.501	0.848	1.54	33.540***	-1.082*
in state senate	(1.094)	(1.492)	(0.644)	(1.783)	(8.178)	(0.660)
Commission	-0.459*	-0.724*	0.456***	-0.176	-1.179**	0.363***
members	(0.259)	(0.481)	(0.069)	(0.323)	(0.540)	(0.092)
Sliding scale plans				-1.474***		1.148***
in electr. industry				(0.567)		(0.252)
Price caps					5.480**	-0.451**
in electr. industry					(2.379)	(0.188)
Price caps					4.755**	-2.055***
in telecom industry					(2.197)	(0.293)
Sliding scale plans in				-0.262		0.763***
gas industr. in region				(0.274)		(0.090)
Price caps in					-2.580***	-0.921***
gas industr. in region					(0.677)	(0.125)
Choice programs in						-1.768***
gas industr. in region						(0.352)
Price of gas				0.054***	0.257***	-0.125***
v. other utilities				(0.016)	(0.069)	(0.024)
Utility volume				0.006***	0.062***	0.001
v. other utilities				(0.002)	(0.015)	(0.001)
Herfindahl				0.074	2.026***	0.014
-Hirschmann Index				(0.181)	(0.409)	(0.065)
Pers. income				0.178	-0.34	-0.670***
				(0.230)	(0.407)	(0.092)
Unemployment rate				-1.006***	-1.771***	-0.477***
				(0.202)	(0.321)	(0.088)
Business income tax				-0.61	-2.239	1.217***
				(0.919)	(1.561)	(0.396)
Observations (Utilities) [States]		3,646 (659) [47]			3,419 (657) [47]	
Log pseudo-likelihood		-2,134.51			-1,612.74	
Wald Chi-square		400.03			1,464.21	

* statistically significant at 10%; ** 5%; *** 1%, two-sided tests. Standard errors, in parentheses, are corrected for heteroskedasticity and autocorrelation at the utility level. Monetary terms are in 1996$. Price and volume of gas sold are at the utility level. Type of operation and ownership of utilities are controlled for in all models; state prices of electricity and electric generators' price of coal are controlled for in the economic model. Number of programs in region excludes program at that utility. Commission and legislature data, programs in other industries, fuel prices, income, unemployment, income tax and Herfindahl-Hirschman Index are at state level. To preserve degrees of freedom, coefficients were restricted to be identical in the two equations for business income tax, and the variable was omitted from the price-cap equation. The number of records used in estimation is technically 10,938 (3,646 for each of the 3 types of deregulation) and 10,257 (3,419*3), respectively.

Table A2. Competing-Risks Cox Hazard Model Results, Sample Limited to Top 25% of Utilities