Job Market Paper

The Political Economy of Incentive Regulation: Theory and Evidence from US States

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Abstract

The determinants of incentive rules are a key issue in industrial policy. Here, I study an asymmetric information model in which incentive rules are chosen by a political principal endowed with two orthogonal and truthful signals. The signals' precisions increase with the effort exerted by two accountable public officials—a regulator and a judge. The model predicts that reforms toward higher powered rules are more likely whenever regulators are elected in spite of being appointed, the less tight is the political competition and the more inefficient (efficient) is the production (information-gathering) technology. US electric power market data confirm these predictions. Besides, the endogenous impact of incentive schemes on prices is statistically indistinguishable from zero, which suggests that their introduction was mainly aimed at incentivating investments.

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I. Introduction

In regulating a natural monopoly with unknown costs, governments should select incentive rules optimally trading off informational rents extraction and cost-saving inducement (Laffont and Tirole, 1993). Yet, politicians put a greater or lesser weight on the firm's profit depending on whether their constituency is dominated by pro-shareholder or pro-consumer sentiments. Besides, the details of incentive contracts are designed by public officials who are accountable either to professional peers or to specific groups of voters and not to the society at large.

The US electric power market along with other US markets is a case in point. Major regulatory reforms, included the recent introduction of incentive regulation, are politically initiated but subject to lengthy quasi-judicial hearings aimed at gathering both the necessary technical information and the consensus of all interested parties. While regulators and judges, who can be either appointed or elected, preside over the hearings, the final policy position is proposed *de facto* by an independent staff. This institutional design is not unique to the US and, in the aftermath of the recent South-American and European privatization wave, a rising need for higher transparency of the regulatory process has exported beyond American boundaries a similar combination of independent staffs and accountable top-level regulators and judges (see Newbery, [2000]).[1] How, therefore, do public officials' incentives and motivations along with political preferences interact with

[1]Remarkably, the Competition Act of 1998 and the Utilities Act of 2000 reformed the UK gas and electricity market institutions introducing a top-level board of three officials—GEMA—appointed by the Secretary of State and supported by an independent staff—Ofgem. The latter proposes the policy position and is subject to a strict transparency requirement which, in turn, "provides the hook for judicial review" (OECD, 2002).

the technological constraints and consequently affect the basic rent extraction-efficiency trade off?

To answer this question, I provide a theoretical framework bridging the canonical principal-agent model of incentive regulation (Laffont 1996, 2000; and Laffont and Tirole, 1993) with two recent strands of political economics. While the first one compares accountable and non-accountable public agents (Alesina and Tabellini, 2007 and 2008), the second contrasts career and legacy concerns in politics (Maskin and Tirole, 2004). Bringing together these bodies of economic theory, I study the incentive rules selection problem performed by a principal faced with a monopoly with unknown costs. The principal receives two truthful and orthogonal signals whose precisions increase with the effort exerted by a regulator and a judge, whom hereafter I will call supervisors. Supervisors respond to implicit incentives—i.e., they are either elected or appointed, which are, in turn, modulated by task specific motivations. Implicit incentives force supervisors to select effort looking at the ballot box (at the preferences of their professional peers) if elected (appointed) but not at the power—in terms of cost reducing effort—of the rule selected by the principal. Under a mild condition on the ability distribution, elected supervisors exert more effort than appointed ones; and, these pro-consumers incentives are stronger (weaker) for judges (regulators) given their fairness motivations (desire of pursuing a career in the industry).[2]

[2] This incentive effect has an impact similar to the Besley and Coate's (2003) selection effect. The latter is driven by the fact that regulation is bundled at elections with more salient policies, and so politicians have electoral incentives and no costs to appoint pro-shareholders officials. Yet, the present force motivates also supervisors not running in partisan elections—e.g., High Court judges appointed under merit plan (for a list of US states using this rule see Hanssen, [2004]).

The principal foresees the effect of this mix of incentives and motivations on the expected probability of remaining uninformed. As a result, the power of the equilibrium incentive rule becomes higher when supervisors are elected and the information-gathering technology is more efficient; and increases (decreases) with fairness (revolving door) motivations. Besides, if the principal is concerned with the amount of cost-reducing investments, the power of the optimal rule rises in to assure higher ex-post rents to the regulated firm. When, instead, investments are profit-enhancing a conflict between shareholders and consumers arises and incentive rules become sensitive to the tightness of the political competition and to the political preferences of the principal.

To test this set of predictions, I analyze US electric power market data at the state level. Consistent with the model, performance based regulation—PBR hereafter—is found where regulators are elected, regulatory resources are more abundant, generation is more costly and political competition is less harsh.

The paper brings three main contributions. First, I formalize and test a theory of complementarities among supervisors' implicit and firms' explicit incentives arising endogenously from the contractibility of the firm's allocation as opposed to the non-contractibility of supervisors' performance. I also offer one of the first accounts of the relation between public officials' intrinsic motivations and regulatory policies (see also Ka and Teske, [2002]; Guerriero, [2009]).

Second, I provide evidence that the observed regulatory institutions reflect both efficiency and strategic political concerns. This is noteworthy because, even if several studies have used cross-state telecommunications (Ai and Sappington, 2002; Eckenrod, 2006) and cross-country electricity data (see Jamasb and Pollitt, [2001]) to show that PBR can deliver lower rates and higher profits, no previous

paper has evaluated the determinants of reforms.[3] Finally, I propose a first test of the endogenous effect of PBR on US electricity rates using a GMM estimator. This last exercise shows that rates were unaffected by incentive rules, suggesting an investment-based explanation to their introduction, and stressing the saliency of an endogenous regulatory institutions research program for policy evaluation.

The remainder of the paper is organized as follows. Section II describes the institutions governing the pricing process in the US electric power market. In section III I first clarify the effect of supervisors' incentives and motivations on incentive rules; next, I endow the planner with partisan concerns and I evaluate the strategic determinants of regulatory reforms. Section IV tests the model's implications, looking at the wave of reforms toward PBR that has interested the market in recent decades. Section V concludes. All proofs, tables and a detailed description of the data are gathered in the Appendix.

II. Institutions

Natural local monopolies and incentive rules.—Investor-owned electric power utilities—IOUs hereafter—account for over three-fourths of the electricity sales of the US electricity market. While jurisdiction over both interstate transmission and wholesale transactions lies with a federal body—the FERC, retail services are regulated by state public utility commissions—PUCs hereafter. The latter deal with several markets—natural gas, telecommunications, insurance, water, etc.—

[3] Recent empirical tests look at the determinants of electricity market restructuring experiences in the US (Ka and Teske, 2002) and around the world (Steiner, 2004) but without providing a formal theory of regulatory actors' incentives as derived by market institutions. Hanssen (2004) provides a first empirical result bridging strategic dynamics and institutional reforms.

and perform several tasks—for example, they suggest lines of conduct on service provision, design environmental regulations and so on, among which price-setting is the most relevant. IOUs are not allowed to receive government subsidies and regulated two-part tariffs have traditionally been linked to realised average costs in order to assure the firms' viability—cost-of-service regulation. Yet, from 1982 on, incentive rules have been applied to 41 among the 144 major US IOUs, partially severing the price-average costs link (Basheda et al., 2001).

Two-tier hearings and supervisors' roles.—Reimbursable costs and target returns are selected during rate reviews which can be triggered by utilities in response to cost shocks, initiated periodically by the PUC (see Friedman, [1991]) or, often, required by the state government in order to assure that a particular rule is implemented.[4] Rate reviews follow a precise routine composed of two levels of formal quasi-judicial hearings open to all interested parties—firms, ratepayers along with state-funded advocates, interest groups, etc.[5] First, commissioners—the head of the PUC—sit on the bench; next, if the filing is not approved or some party finds herself mistreated, a High Court judge—usually sitting in a state supreme court—is asked to rule the case. The appeal is on law and fact and "with so much at stake, [judicial review] is a very real possibility" (Gormley, 1983).[6]

[4] As Lee and Hill (1995) report, the 1995 Maine Alternative Rate Plan was introduced under the thrust of several laws—e.g., 1988 Least-Cost planning—approved by the Republican legislature.

[5] I follow Friedman ([1991], pp. 92–98), CDRA ([1992], pp. 52–68) and Gormley ([1983], pp. 92–98) whose overviews are highly consistent with those reported on the PUCs' websites.

[6] A huge body of press testimonies and empirical evidence highlights the critical role of judicial review. The appellate rate of PUC decisions reached between 1974 and 1979 the mean level of 37.4 percent with a share of partially reversed cases of 43.5 percent, and a peak of 52.3 percent and (Gormley, 1983). Teske ([2004], ch. 15) reports similar figures for the 1995-1996 period.

During the hearings, the role of commissioners and judges is one of supervision. They examine witnesses and experts, receive the evidence and interpret prevailing precedents and regulations. The final motion to be approved, however, is proposed *de facto* by the PUC's staff, who acts as the jury in the typical Anglo-American adversarial trial.[7] The reason is that decisions should always be reached in "an open and fair manner" (CDRA, 1992).[8] This feature, along with the fact that the complete record of the hearings is widely publicized and all interested parties participate, assures that only if "hard" evidence—such that "every interested party can convince himself that [the judgment] corresponds to the true state of the world" (Laffont, 2000)—is obtained does the review end.

Accordingly, I set up a model in which incentive rules are selected by a planner obtaining orthogonal and truthful signals on the firm's technology. The precision of the signals increases with the effort exerted by a regulator and a judge. If benevolent, the planner represents a fiction for the Coasian bargaining among interested parties necessary to implement a reform. If partisan, a major emphasis is placed on political competition.

Supervisors' incentives.—Media carefully track the evolution of electricity files, which, in turn, represent some of the most advertised tasks over which regulators and judges are selected. High court judges and PUC commissioners are either

[7] "The judge just listens attentively. If it speaks, it will be to rule, at the request of the party or on his own motion, on the admissibility of a question put to a witness or a party or to ensure adherence to the rules of the game"(Zweigert and Kötz, [1998], pp. 272 – 273).

[8] Commissioners consider the staff as the most influential hearing actor (Gormley, 1983; Ka and Teske, 2002). While a part—trial staff—suggests a pre-hearing position, another—advisory staff––proposes the final motion (CDRA, 1992). Furthermore, courts usually examine the staff before issuing the judgement (Gormley, 1983).

elected or appointed. Coherently, I assume that supervisors are rewarded on the basis of the extent of hard information—reported in the docket official papers—they obtain during the hearings. Besides, I explicitly model the role of selection rules and of regulatory and judiciary specific motivations in the pricing process.

III. Theory

The model takes its approach from Laffont and Tirole (1993), and includes a planner and two implicitly and intrinsically motivated supervisors.

III.A Preliminaries

Preferences and information.—The regulated firm produces a variable scale product q, charging a two-part tariff $A+pq$ with q, A and p strictly positive. The total cost is $C=(\beta-a)q=cq$ where $a>0$ is the manager's effort and $\beta>0$ is an inefficiency parameter which is equal to $\underline{\beta}$ with probability v and to $\overline{\beta}$ with probability $1-v$. Define $\Delta\beta\equiv\overline{\beta}-\underline{\beta}>0$. Effort a lowers the marginal cost c of a and implies a disutility in monetary units for the manager of $\psi(a)$ with $\psi(0)=0$, $\lim_{a\to\beta}\psi(a)=\infty$, $\psi'>0$, $\psi''>0$ and $\psi'''>0$. This last assumption assures that the optimal incentive rule is deterministic.

Consumers share the same preferences, and the demand is that of a representative consumer. Let $S(q)$, $p=P(q)=S'(q)$, $q=D(p)$ and $R(q)=P(q)q+A$ label the gross surplus, inverse and regular demand functions, and the firm's revenue. Consumers choose q in order to maximize the net surplus $S(q)-A-pq$, and A is fixed optimally to make them indifferent between buying or not the

good: i.e., $A \equiv S(q) - P(q)q$. The firm's utility is $U = t - \psi(a)$, and the reservation level of 0 is required. Besides, total revenues must cover costs and managerial rewards t. Thus, the budget constraint $A + (p-c)q(p) \geq t$ needs to be satisfied.

The planner's problem.—Ex post social welfare W is the sum of the net consumer surplus and of the firm's utility. The firm's budget constraint is evaluated at the shadow price of the managerial rewards $1+\lambda$ and consequently[9]

$$W = S\big(q(p)\big) - A - pq(p) + U + (1+\lambda)\big[A + (p-c)q(p) - t\big]. \qquad (1)$$

Let $V(q)$ denote the social surplus brought about by the production of q. Given that the good is private, V is the sum of the consumers' net surplus plus the firm's revenue, computed at the shadow price $1+\lambda$—because it helps to fulfil the firm's budget constraint. So, $V(q) = \big(S(q) - R(q)\big) + (1+\lambda)R(q) = (1+\lambda)S(q)$ with $V(0) = 0$, $V' > 0$, $V'' < 0$, $-V''\psi'' > 1+\lambda$. The strictly concave objective in (1) rewrites as:

$$W = V(q) - (1+\lambda)\big[(\beta - a)q + \psi(a)\big] - \lambda U. \qquad (2)$$

Under complete information, the planner achieves the first best allocation $\psi'(a^*) = q^*$ through a fixed price contract on t—see the Appendix. No rent is left to the firm. Instead, under asymmetric information, the planner observes total costs and output but not the inefficiency parameter. The planner offers the firm a menu of incentive compatible pairs (t,c) trading off informational rent extraction and allocative distortion. Let $\big\{(\underline{t},\underline{q},\underline{C},\underline{c},\underline{U},\underline{a}),(\overline{t},\overline{q},\overline{C},\overline{c},\overline{U},\overline{a})\big\}$ denote the managers'

[9] Joskow and Schmalensee (1986) suggest that A here covers a role similar to the governmental transfers in Laffont and Tirole (1993). Thus, my analysis is formally similar to the latter when reimbursement is intended to be operated through regulated prices. In the present case, the shadow cost of public funds is replaced by the marginal deadweight loss from a rise in the fixed fee.

rewards, output, total and marginal costs, utility and effort of the high and low cost—low and high type—firms respectively. Individual rationality and incentive compatibility imply a binding high cost firm's individual rationality constraint

$$\overline{U} = \overline{t} - \psi\left(\overline{\beta} - \overline{c}\right) = 0, \qquad (IR\_L)$$

and a binding low cost firm's incentive compatibility constraint

$$\underline{U} = \underline{t} - \psi\left(\underline{\beta} - \underline{c}\right) = \overline{U} + \psi\left(\overline{\beta} - \overline{c}\right) - \psi\left(\underline{\beta} - \overline{c}\right) = \Phi\left(\overline{a}\right), \qquad (IC\_H)$$

where $\Phi(a) \equiv \psi(a) - \psi(a - \Delta\beta)$ with $\Phi' > 0$, $\Phi'' > 0$ because $\psi''' > 0$.[10]

Thus, under asymmetric information, expected social welfare is $\tilde{W} =$

$$v\left[V\left(\underline{q}\right) - (1+\lambda)\left[\left(\underline{\beta} - \underline{a}\right)\underline{q} + \psi\left(\underline{a}\right)\right] - \lambda\Phi\left(\overline{a}\right)\right] + (1-v)\left[V\left(\overline{q}\right) - (1+\lambda)\left[\left(\overline{\beta} - \overline{a}\right)\overline{q} + \psi\left(\overline{a}\right)\right]\right]. \qquad (3)$$

Except for the expected rent $v\lambda\Phi\left(\overline{a}\right)$, the optimization is the same as in (2). Prices are not distorted for rent extraction, and incentive concerns are entirely taken care of by the incentive scheme. Define $\Gamma(x) \equiv x(1-x)^{-1}$ with $\Gamma' > 0$. In order to limit the high type's rent, the low type receives a low powered rule—$\hat{\overline{a}} < a^*$:

$$\psi'\left(\hat{\overline{a}}\right) = \hat{\overline{q}} - \frac{\lambda}{1+\lambda}\Gamma(v)\Phi'\left(\hat{\overline{a}}\right). \qquad (4)$$

The supervision technology.—Let me now introduce two supervisors—a regulator and a judge—who, exerting costly effort, produce two independent signals that are observed by the planner. The signals' precision is ξ_l with $l = \{R, J\}$.

If $\beta = \underline{\beta}$, with probability ξ_l the planner sees $\underline{\beta}$ and implements the full information contract and with probability $1 - \xi_l$ she observes ϕ—i.e., she remains

[10] Incentive compatibility prescribes that the contract designed for type $\underline{\beta}$ $(\overline{\beta})$ is the one preferred by type $\underline{\beta}$ $(\overline{\beta})$ in the menu of managerial rewards-marginal cost pairs. This amounts to saying that:

$$\underline{t} - \psi\left(\underline{\beta} - \underline{c}\right) \geq \overline{t} - \psi\left(\underline{\beta} - \overline{c}\right) \qquad (IC\_H) \qquad \text{and} \qquad \overline{t} - \psi(\overline{\beta} - \overline{c}) \geq \underline{t} - \psi(\overline{\beta} - \underline{c}). \qquad (IC\_L)$$

uninformed.[11] If, instead, $\beta = \overline{\beta}$ the planner observes ϕ always.[12] The planner always assures a reservation utility r to the two supervisors, who always participate in the game and are not allowed to side contract with each other. The regulator moves first. If the planner remains uninformed, the judge generates an orthogonal signal with the same structure. Supervisors are evaluated on the observable but not contractible $\xi_l = \alpha e_l$; finally, $\alpha \in [0,1]$ is the common ability and $e_l \in [0,1]$ the unobservable effort.[13] The parameter α is drawn from a distribution with mean $\overline{\alpha}$, variance σ_α^2, cumulative function F, and density f independent of e_l. In order to analyze the two interesting cases in which there are or not extreme types—i.e., $f(0) = f(1) = 0$ or $f(0) \neq f(1) \neq 0$, I shall focus on the class of canonical, non degenerate, continuous distributions supported on a bounded interval and with hump-shaped density: Beta, raised cosine, generalized

[11] The set up is justified, in the case of the US electricity market, by the nature of the evidence processing—which is *de facto* devolved upon the staff—and the extent of judicial review—*de novo* hearings. The contractability of the precision will lead to the first best but "does not even come close to any observed institutional arrangement" (Alesina and Tabellini, 2007).

[12] Under different information structures, the power of the firm's contract can decrease with the precision of the signal (Boyer and Laffont, 2003): yet, as Laffont ([2000], pp. 31) stresses, only the technology employed here assures that the planner cannot reach the first best contract under the threat of not contracting, exactly because the high type is always able to mimic the low one when the signal is uninformative. Besides, the hearings are aimed at obtaining information justifying a limited price increase: i.e., gathering information proving that the firm is efficient.

[13] The effort has to be considered correctly as net of all the activities intended to hide valuable information. A multiplicative technology avoids the tiresome qualifications that an additive one needs: the choice, however, is immaterial. If the performance is any continuous and increasing function of the precision—e.g., expected social welfare, all the results remain unaffected.

Kumaraswamy, inverted U-quadratic, and truncated normal (see Johnson, Kotz, and Balakrishnan, [1994]). Moreover, I shall assume that:

A1: When f is truncated normal $\sigma_\alpha\left[F\left((1-\bar{\alpha})/\sigma_\alpha\right)-F\left(-\bar{\alpha}/\sigma_\alpha\right)\right]<1/\sqrt{2\pi}$.

The assumption assures that, for all the distribution in the class, the density f is not too flat at the mean, and, in particular, that $f(\bar{\alpha})>1$. As a result, the marginal probability of drawing a supervisor with less than average talent is not too low. In the most sensible case, in which there are not extreme types—Beta, generalized Kumaraswamy, raised cosine, and inverted U-quadratic—the requirement is always met—proofs available from the author. When, instead, this is not the case—truncated normal—the regularity on the measure of completely skilled and unskilled types, contained in A1, is required.[14] Nevertheless, this last assumption has to be considered as an essentially mild one given the high complexity and the fast changing nature of the regulation task.

Supervisors' objective functions.—As suggested by Maskin and Tirole (2004), I suppose that supervisors respond to both implicit incentives and intrinsic motivations: they not only value being in office for its own sake but they also wish to leave a legacy. In other words, not only being reappointed or re-elected brings valuable perquisites or satisfies tastes for influence—implicit incentives, but supervisors want to be remembered for great things they have accomplished in favour of the society at large, or of a part of it—intrinsic motivations.

Thus, I posit that a supervisor's utility depends on both her identity—being a regulator or a judge—and the degree of accountability to which she is

[14] Some non-continuous distributions in the same class—for example, triangular—have the same property. To be hump-shaped, the Beta and Kumaraswamy need to have parameters greater than 1.

subjected—being elected or appointed. Therefore, a generic supervisor's interim —relative to the moment in which she exerts effort—utility function writes as

$$\tilde{R}_{i,l}\left(e_{i,l},S\right)=\left\{1+\left[\left(1-SR\right)G^{i}\left(e_{i,l}\right)-\left(1-\left(1-S\right)J\right)\left(1-K\right)\tilde{C}\left(e_{i,l}\right)\right]\right\}r, \tag{5}$$

where $i=\{A,E\}$ indexes the appointment rule to which she is subjected. $K\in(0,1)$ is an efficiency of the information gathering technology parameter and the effort cost function has $\tilde{C}(0)=0$, $\tilde{C}'>0$, $\tilde{C}'(0)<\infty$, $\tilde{C}''>0$, $\lim_{e_{i,l}\to 1}\tilde{C}'\left(e_{i,l}\right)=\infty$. The term in square brackets represents the non-monetary bonus obtained over and above r. Besides, the shape of the implicit rewards function $G^{i}(\cdot)$ differentiates appointed from elected officials and S distinguishes regulators from judges. In particular, S is equal to 1 for a regulator and to 0 for a judge. In order to grasp a deeper understanding of nonmonetary incentives, I shall leave aside signalling and money-burning incentives and assume that supervisors select effort before knowing their random ability. Then, nature chooses α. Next, the outcomes are observed. Finally, supervisors obtain the nonmonetary rewards inclusive utility.

For what concerns implicit incentives, I embrace the distinction between politicians and bureaucrats proposed in Alesina and Tabellini (2007): while elected officials are held accountable by voters at election time, appointed ones are accountable to their professional peers or to the society for the way that they fulfil the goals of their organization. In particular, the latter want to maximize the conditional perception of their ability. Therefore, if $\mathrm{E}[\cdot]$ denotes the supervisor's unconditional expectation over $\xi_{A,l}$, E the evaluator's expectation over α conditional on $\xi_{A,l}$ and $e_{A,l}^{\exp}$—the correct in equilibrium evaluator's expectation over effort, then $G^{A}\left(e_{A,l}\right)=\mathrm{E}\left[E\left(\alpha\middle|\xi_{A,l},e_{A,l}^{\exp}\right)\right]$. Turning to voters, they realize that the

alternative to the incumbent is an average talented official exerting effort $e_{E,I}^{\exp}$. So the incumbent is re-elected if the realized performance is greater than $\tilde{\xi}_{E,I} = \bar{\alpha} e_{E,I}^{\exp}$ or $G^E\left(e_{E,I}\right) = \Pr\left\{\xi_{E,I} \geq \tilde{\xi}_{E,I}\right\} = \Pr\left\{\alpha \geq \left[\bar{\alpha} e_{E,I}^{\exp} / e_{E,I}\right]\right\}$. In order to simplify the analysis, let me normalize the market value of talent and the value of office holding to 1.

Turning to intrinsic motivations, $J \in (0,1)$ and $R \in (0,1)$ measure the "fairness" and the "revolving door" motivations. Political and legal scholars have assumed that judges try to make the ex post right decision in order to signal their fairness and commitment. Miceli and Coşgel (1994) envision that judges suffer a utility loss when overturned and gain utility when cited and Gennaioli and Shleifer (2008) suppose that judges want to minimize type one and two errors. The disclosure of the firm's information, instead, is less appealing for officials attracted by future job opportunities in the industry (see Gormley, [1983]). As Quirk (1981) shows, more pro-industry US federal regulators anticipate enhanced chances of working for regulated firms. Therefore, I assume that the judges' cost of exerting effort (the regulators' implicit rewards) decreases with J (R).

The timing.—The timing of the game is as follows:

1. Society—that is, the planner, the supervisors and the firm—learns the nature of the regulatory environment—$P, \beta \in \left\{\underline{\beta}, \bar{\beta}\right\}$. Next, the firm discovers the value of β.

2. The planner offers the firm a menu of (t,c) pairs conditional on the eventual signals. If the firm declines, the game ends.

3. The regulator chooses her level of effort; then, she discovers the α. Next, the planner receives a signal. If this is informative the first best is implemented.

4. If the planner remains uninformed, the judge chooses her level of effort; then, she discovers the α. Next, the planner receives a second signal.

5. If also the second signal is uninformative, the planner asks the firm to report its information. Next, the firm exerts her effort and the (t,c) contract is implemented. Finally, the precisions of the signals are revealed and each supervisor is rewarded.

Implicit incentives build into the model a division of power structure: officials care about their evaluators' moves and not about the incentive scheme selected by the planner. This model's feature has three consequences. First, implicit incentives reduce the scope for side-contracts between the firm and the supervisors because, when side contracts are accepted, the firm has to reimburse all nonmonetary rewards to the supervisors. Second, if the firm's informational rent is not only a loss, as it is in equation (3) is, supervisors' and planner's goals can collide (see also Guerriero [2009]). Third, the basic equilibrium can be easily obtained solving separately the supervisors' and the planner's problems. Before looking at the details of the first two points, I shall illustrate the last one.

III.B Firm's Extrinsic Incentives vs. Supervisors' Implicit Incentives

The solution concept is perfect Bayesian equilibrium. The latter can be characterized by a tuple of equilibrium efforts, one for each possible supervisor's type, and a menu of (t,c) pairs contingent on the signals realizations. Proceeding by backward induction, the solution to the supervisors' problem implies that:

LEMMA: *Label the regulators' (judges') selection rule with* i (j)*. Each supervisor's problem has a unique and interior solution. In addition, equilibrium efforts* $\hat{e}_{i,j}$ *are such that, for all* f *in the class considered: (1)* $\partial\hat{e}_{i,R}/\partial R<0\forall i$, $\partial\hat{e}_{j,J}/\partial J>0,\forall j$, $\partial\hat{e}_{i,l}/\partial K>0\forall i,l$ *and* $\partial\hat{e}_{j,l}/\partial K>0\forall j,l$*; also, (2) under A1,* $\hat{e}_{E,l}>\hat{e}_{A,l},\forall l$.

Point 1 underscores not only the role of a more efficient information-gathering

technology but also the effects of opposite legacy goals: the effort exerted by supervisors striving to please the industry (to be ex-post correct) tends to decrease (increase) as the congruency with original tasks fades away. Even more crucially, point 2 states that, whenever it is not too easy to substitute an incumbent supervisor for a mean-ability one—that is, when A1 holds, an elected supervisor panders to voters exerting more effort than would an appointed one.[15]

Despite the different set up, the result is driven by an incentive similar to the pandering ones identified by Maskin and Tirole (2004).[16] At stage 2, the planner offers the firm a menu of (t,c) pairs which are function of the expected signals' precisions. If $\gamma(i,j) \equiv \bar{\alpha}\hat{e}_{i,R} + (1-\bar{\alpha}\hat{e}_{i,R})\bar{\alpha}\hat{e}_{j,J}$, the planner's posterior on $\underline{\beta}$ conditional on two uninformative signals is $\Pr\{\beta = \underline{\beta} | \phi, \phi\} = v(1-\gamma(i,j))/[1-v\gamma(i,j)]$, and her optimum problem, indexed by S —that is supervision, writes as $\tilde{W}^S =$

$$v\gamma(i,j)\underline{W}^* + [1-v\gamma(i,j)]\left\{\frac{v[1-\gamma(i,j)]}{1-v\gamma(i,j)}\left[V(\underline{q}^s) - (1+\lambda)\left[(\underline{\beta}-\underline{a}^s)\underline{q}^S + \psi(\underline{a}^s)\right] - \lambda\Phi(\bar{a}^s)\right] + \right.$$

$$\left. + \frac{1-v}{1-v\gamma(i,j)}\left[V(\bar{q}^s) - (1+\lambda)\left[(\bar{\beta}-\bar{a}^s)\bar{q}^s + \psi(\bar{a}^s)\right]\right]\right\} - 2(1+\mu)r\,,$$

where $\underline{W}^*$ is the first best welfare obtained when at least one signal is informative. The planner evaluates supervisors' monetary perks at the shadow cost of public funds $1+\mu$ and, without loss of generality, does not value implicit incentives. All

[15] When the shape parameters equal 1, the Beta and Kumaraswamy become uniform and the inequality holds as equality—that is, elected and appointed supervisors exert the same effort.

[16] Focusing on normally distributed talent observable with noise, Alesina and Tabellini (2007) show that a sufficiently high uncertainty over talent implies patterns opposite to those in point 2. Yet, a similar scenario is not realistic in the present instance: regulatory policies are widely publicized—talent observed without noise—and supervisors' curricula vitae are consistent one with the other—small dispersion of possible ability levels.

the novelties in the optimum problem, which has a unique and positive solution, are contained in the expected ex post probability of at least an informative signal $\gamma(i,j)$. Again, the rule giving prices as a function of marginal costs is the same as the full information case—that is, $V'\left(\hat{\bar{q}}^{s}\right) = \hat{\bar{c}}^{s} = \bar{\beta} - \hat{\bar{a}}^{s}$—and the planner offers the high cost firm a scheme less powered than the first best and in particular:

$$\psi'\left(\hat{\bar{a}}^{s}\right) = \hat{\bar{q}}^{s} - \frac{\lambda}{1+\lambda}\Gamma(v)\left[1-\gamma(i,j)\right]\Phi'\left(\hat{\bar{a}}^{s}\right). \tag{6}$$

Clearly, the hierarchical hearings structure is useful, and the allocative distortion is partially curbed with respect the solution in (4)—i.e., $\hat{\bar{a}} < \hat{\bar{a}}^{s} < a^{*}$. In particular, given that $\gamma(i,j)$ increases with $\hat{e}_{i,R}$, $\hat{e}_{j,J}$, the following is true:

PROPOSITION 1: *The power of the optimal incentive rule rises with the efficiency of the information-gathering technology, is increasing (decreasing) with the strength of judges' (regulators') intrinsic motivations and—under A1—is greater whenever supervisors are elected.*

The main innovation of Proposition 1 rests in underlining that supervisors' implicit incentives and firm's explicit incentives are complement.[17] The pattern resembles the relation between career concerns and monetary rewards in labour contracts proposed by Gibbons and Murphy (1992). However, in contrast to the latter, the present result refers to players who belong to different tiers of the hierarchical structure but are linked by the revelation principle. When pandering incentives are stronger—because election is used instead of appointment—the expected probability of informative signals increases, and the planner relaxes the

[17] The assumption according to which the planner does not choose supervisors implicit incentives is relaxed in Guerriero (2009), who employs the same model to assess the efficiency-enhancing and rent-seeking determinants of the election versus appointment comparison.

allocative distortion offering the low type a more powerful contract. Fairness motivations reinforce complementarities; revolving door concerns limit them.

The appeal of these results lies not only in the sensibility of the model's premises which bridge implicit incentives and task-specific motivations to the asymmetry in information but also in the realism of the consequences. Studying a similar environment, the new regulatory economics (Laffont and Martimort, 1999; Laffont, 2000) obtains collusion-proof equilibria in which monetary perks equal to the firm's expected stake are given to explicitly interested supervisors to avoid corruption. This pattern matches consistent evidence on regulatory reforms (Gormley, 1983; Ka and Teske, 2002) which has clarified the narrow role of capture but is completely at odds with any observed regulatory contract.[18] The equilibrium discussed in Proposition 1, instead, has similar collusion-proofness properties but builds on the observed residual rights nature of supervisors' activities. The next section explains this point in detail.

III.C Robustness: Lobbying and Bribery

Supervisors exert also effort in other tasks. I assume that a firms' lobby tries to divert supervisors' effort from information gathering to the fulfilment of a second task—e.g., avoiding by-passing by non-regulated firms. The technology of this task is $h_{i,l} = \alpha e^h_{i,l}$ and its benefits are negligible for consumers and $\kappa h_{i,l}$—with $\kappa > 0$—for the firm. Following Alesina and Tabellini (2008), the planner does not foresee equilibrium capture and cannot condition her choice—that is, incentive

[18] Collusion proof contracts are simply unrealistic if supervisors' monetary rewards are evaluated against the firm's stake: over the period 1980-1997, for instance, IOUs average revenues from retail sales were 1.94 billion dollars while the commissioners' average salary was 59,774 dollars.

schemes—on the supervisors' collusive activities; α is truncated normally distributed, and the supervisors' effort cost function is additive. Besides, the lobby, whose vote is irrelevant, has all the bargaining power and, in stage 2 commits to bribes $b_{i,l}$ and/or campaign contributions $n_{E,l}$ to elected supervisors only to be paid after stage 5. Both of these influence instruments are contracts contingent on the efforts exerted in the two tasks, but bribes are illegal and, if a supervisor accepts them, with probability $\upsilon > 0$ she is caught and pays a fine $M > 0$. Thus, when $\tau > 0$ measures the value of implicit rewards relative to illegal bribes, supervisors' utility—indexed by C; that is, capture—rewrites as

$$R_{i,l}^{C}(e_{i,l}^{C}, e_{i,l}^{h}, S) = \left\{1+\tau\left[(1-SR)G^{i}\left(e_{i,l}^{C}, e_{i,l}^{h}\right)-\left(1-(1-S)J\right)(1-K)\tilde{C}\left(e_{i,l}^{C}+e_{i,l}^{h}\right)\right]\right\} r + b_{i,l} - \upsilon M \,.$$

Implicit rewards are the same as in (5) when appointment is used but they differ if election is employed. Indeed, campaign funds lower voters' reservation utility to $\tilde{\xi}_{E,l}^{C} = \bar{\alpha} e_{E,l}^{\exp} - H\left(n_{E,l}\right)$ with $H(0)=0$, $H'>0$, $H''<0$. The lobby's indirect utility is

$$\tilde{U} = v\left[1-\gamma^{C}(i,j)\right]\Phi\left(\hat{\tilde{a}}^{s,C}\right)+\kappa E\left[\alpha\left(\hat{e}_{i,R}^{h}+\hat{e}_{j,J}^{h}\right)\right]-\left(\hat{b}_{i,R}+\hat{b}_{j,J}\right)-\left(\hat{n}_{E,R}+\hat{n}_{E,J}\right),$$

where hats indicate equilibrium values. The subgame perfect equilibrium of the menu auction bribing game and of the lobbying game are jointly optimal for the organized group and the supervisor, given the evaluators' expectations.

Tedious algebra—proofs available from the author—shows that for τ sufficiently large appointed supervisors never accept bribes, and that the lobby prefers to be ex-ante passive rather than pay bribes if the firm's stake is too narrow or legal systems work efficiently, that is υM is large. Strong (weak) fairness (revolving door) motivations favour capture-free equilibria. Full-capture equilibria—with zero information gathering effort—with positive campaign funds are never optimal because supervisors lose election. Also, the lobby is not willing

to offer campaign aids if money is not very effective in swaying votes—H' is small. Thus, sufficiently strong implicit incentives and/or an inefficient corruption technology make the equilibrium in Proposition 1 endogenously collusion-proof.

III.D Investment Concerns and Strategic Regulatory Reforms

Yet, the picture painted so far is, at least, partially incomplete: it takes into account static dimensions of regulatory performance but it does not deal with the impact of incentive regulation on the firm's investment decisions. Indeed, a sharp tension between rent extraction and investment inducement arises in industrial policies. As shown by Laffont and Tirole (1993), whether or not the planner can commit to reimburse investment costs, the equilibrium can envision ex post expropriation of sunk investments (see also Ajodhia and Hakvoort, [2005]). On the one hand, this dynamic inconsistency optimally pushes toward more powerful schemes, on the other, it creates the risk that inefficiently powered incentives are imposed on the firm if reforms are directed by political parties committed to decide in favour of their own constituency and subject to uncertain elections.

In the next section, I will first clarify the efficiency effect maintaining the planner's benevolence, and then I consider the positive determinants of incentive rules allowing for planner's political interests. In order to illustrate the point most clearly, I shall suppose that the planner cannot commit to reimburse investment expenses but correctly anticipates the firm's moves.[19] The assumption reflects the lack of formal guarantee of productivity offsets typical of incentive contracts (see

[19] Even if the used and useful US doctrine constitutes a partial assurance against non-commitment, the assumption is the more appropriate in technologically mature and mass markets such as electricity, where a firm retaliation strategy could not be very damaging (Newbery, [2000], ch. 2).

Basheda et al., 2001) and is not at all restrictive. Indeed, under commitment, whether or not contractibility is assumed, not only the results continue to hold but also a bargaining inefficiency arises (see Laffont and Tirole, [1993], ch. 1).

Benevolent Planners

Before learning β, the firm commits a monetary investment which cost per unit of final product is $I \geq 0$. The investment rises the ex ante probability of being a high type to $\tilde{v}(I) = v\left[1+\zeta(I)\right]$—i.e., a higher I makes it more likely that the firm is efficient. The cost-reducing technology is efficient enough, exhibits decreasing returns and it is imperfect: i.e., $\zeta' \geq q/(v\Delta\beta)$, $\zeta'' < 0$, $\lim_{I\to\bar{\bar{I}}} \zeta'(I) = \infty$, $\bar{\bar{I}} = \zeta^{-1}(\bar{v}) = \infty$, $\bar{v} = \Gamma(v)^{-1}$. In the investment regime—notice the index I, the firm chooses $\hat{I}$ to maximize expected ex post rents minus investment costs:

$$\hat{I} \in \arg\max_{I\geq 0} \left\{\tilde{v}(I)\left[1-\gamma(i,j)\right]\Phi\left(\hat{\bar{a}}^{S,I}\left(\hat{I}\right)\right) - Iq\left(\hat{I}\right)\right\}. \qquad (7)$$

The firm under-invests with respect to the social optimum (see the Appendix) and a decrease in the power of the incentive rule depresses expected ex post rents. Thus, a benevolent planner should select higher-powered schemes if investment decisions are sufficiently relevant.[20] Formally, I shall assume that the firm's utility enters the planners' objective function with an extra weight χ with $\lambda > \chi > 0$ so that expected welfare rewrites as $\chi\tilde{v}\left(\hat{I}\right)\left[1-\gamma(i,j)\right]\Phi\left(\bar{a}^{S,I}\right) + \tilde{W}^{S}\left(\tilde{v}\left(\hat{I}\right)\right)$, where the dependence on the expected probability of a high type is made explicit. The low type's contract is now pinned down by

[20] Investment shortages also have a negative effect on service reliability and quality. Basheda et al. (2001) suggest that the restructuring-related investment uncertainties and the reduced availability of hydroelectric generation were two of the main causes of California's liberalization failures.

$$\psi'\left(\hat{\bar{a}}^{S,I}\right) = \hat{\bar{q}}^{S,I} - \frac{\lambda - \chi}{1+\lambda}\Gamma\left(\tilde{v}\left(\hat{I}\right)\right)\left[1 - \gamma\left(i, j\right)\right]\Phi'\left(\hat{\bar{a}}^{S,I}\right),$$

and by the first order condition to (7). Fixed-price contracts reach efficiency but leave a disproportionate rent to the firm. Optimal rules take into consideration contemporaneously rent extraction, cost reducement and investment inducement.

PROPOSITION 2: *The power of the optimal incentive scheme increases with the planners' investment concerns* χ.

The result is similar to the one obtained by Sappington (1986), who claims that institutions preventing the regulator from observing the firm's costs are optimal if the expropriation of investments is a real issue. Even if cost-reduction is undoubtedly in interest of society, quality and reliability-enhancing investments can affect consumers asymmetrically if only some of them are also shareholders. Next, I prove that incentive rules reflect this conflict if the planner is a political party accountable to her constituency, and re-election is uncertain.

Partisan Planners

Suppose that now the incentive rule is selected by the incumbent between the pro-shareholder party R and the pro-consumer D, and add to the steps considered in the timing studied in section III.B the following two time periods:

6. An election with exogenous winning probability x_m —$m = D, R$—is held. The winner can, exerting effort ρ_m, ease the firm's private-funds-seeking activity.

7. The firm eventually commits to an investment of fixed cost $\bar{I} \geq 0$, stochastic return with expected value $\pi\bar{I}$ and $\pi \equiv \bar{\pi}\delta + \underline{\pi}\left(1 - \delta\right) > 0$, $\bar{\pi} > 0 > \underline{\pi}$, $\delta > 0$.

The firm is infinitively risk averse in the range of the ex-post negative utilities and, therefore, only the high type invest whenever

$$\Phi\left(\hat{\bar{a}}_{\tilde{m}}^{S,I}\right)+\underline{\pi}\bar{I}\geq 0, \tag{8}$$

where $\tilde{m}=D,R$ indexes the incumbent party.[21] Each party attaches to the ex-post participation to the investment game–constraint (8) both the common shadow price $1+o>1$ and a specific investment concern $\chi_{\tilde{m}}$ capturing the party's willingness to leave a higher ex post rent to the shareholders. Let me label $\rho_D x_D+\rho_R x_R\equiv\tilde{x}$. I assume the following restrictions on the exogenous parameters:

A2: $\rho_R > \rho_D > 1$; $\chi_R \equiv 1+o-\theta < 1+o+\theta \equiv \chi_D$; $\theta > 0$; $\tilde{x} < \lambda/\theta$.

Therefore, the incumbent maximizes:

$$\tilde{W}_{\tilde{m}}^{S,I}=\tilde{W}^{S}+\left(1+o-\chi_{\tilde{m}}\right)\tilde{x}v\left[1-\gamma\left(i,j\right)\right]\Phi\left(\bar{a}_{\tilde{m}}^{S,I}\right).$$

In interpreting the foregoing, several observations should be borne in mind. First, the non-monetary nature of ρ_m simplifies the analysis assuring that the ex post participation constraint enters the expected welfare without the shadow price of public funds. Second, the restriction according to which the winning party cannot reform incentive rules squares with the typical commitment period common to almost all PBR contracts (Basheda et al., 2001).[22] Third, the fact that the pro-shareholder party exerts a higher investment-enhancing effort and dislikes less leaving an extra ex post rent to the firm is in the spirit of those models of electoral competition in which candidates commit to well-defined

[21] The latter is the case even if perfect financial markets are available, provided that $-\underline{\pi}\bar{I} > \Phi\left(\hat{\bar{a}}_{\tilde{m}}^{S,I}\right)\left(\rho_{\tilde{m}}-1\right)$. If the aid is monetary, the analysis continue to hold under the assumption that party R dislikes more resorting to distortionary taxes in order to finance the aid (see Guerriero, [2008]).

[22] The set up matches the stylized fact that incentive regulation "can also be designed to encourage other goals, such as maintaining or improving service quality and encouraging certain investments (e.g., network modernization or energy efficiency investments)" (Basheda et al., 2001).

policies ahead of elections and then stick to them (for a review see Persson and Tabellini, [2000]). Fourth, the last two restrictions in A2 assure that the other propositions continue to hold. All in all, the equilibrium low type's allocation is

$$\psi'\left(\hat{\tilde{a}}_{\tilde{m}}^{S,I}\right) = \hat{\tilde{q}}_{\tilde{m}}^{S,I} - \Gamma(v)\left[1-\gamma(i,j)\right]\left[\frac{\lambda}{1+\lambda} - \frac{1+o-\chi_{\tilde{m}}}{1+\lambda}\tilde{x}\right]\Phi'\left(\hat{\tilde{a}}_{\tilde{m}}^{S,I}\right), \qquad (9)$$

which, in turn, implies (see the Appendix) that:

PROPOSITION 3: *Under A2, the power of the optimal scheme rises with the incumbent grip on power* x_m *and is greater if the reformer is pro-shareholder.*

While the second part of Proposition 3 is in tune with Laffont (1996), the first one differs from the conclusion of this seminal paper. There the relation between the likelihood of a reform toward more powerful rules and the hold on power of the incumbent is negative when the reformer is pro-shareholder party and null otherwise. The actual pattern originates from both the asymmetry in the parties' preferences and the uncertainty of elections and is similar to the strategic dynamic incentive pointed out by a long tradition of political economy (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Hanssen, 2004).

This body of research claims that a lack of permanence in office can inspire policymakers to implement reforms either to influence political outcomes or to limit the actions of future incumbents.[23] In a similar way in the present environment, even if both parties value profit-enhancing investments, only the pro-shareholder one prefers investment inducement to shareholder exploitation. An increase in the probability of being re-elected and exerting more (less) effort, without the danger of facing a new institutional reform, pushes party R (D) to

[23] For instance, the reform was promoted in Maine by Republicans who had defeated Democrats a few years earlier. The latter won back the state after the adoption of PBR (Lee and Hill, 1995).

select more powerful rules and so assure an even higher profit to her constituency (curb allocative distortion).[24] Provided that A1 and A2 hold, and with P and β held constant, the above propositions can be restated as testable predictions on the likelihood and the timing of reforms toward higher powered incentive rules as:

TESTABLE PREDICTIONS: *The likelihood of a reform toward more powerful rules will (1) rise if supervisors are elected, increase (decrease) with the strength of fairness (revolving door) motivations, (2) rise with the efficiency of the information-gathering technology and society's investment concerns, (3) increase with the incumbent's grip on power and if the reformer is Republican.*

In what follows, I will test these predictions

IV. Evidence

Between 1982 and 2002, twenty-five US states introduced some form of broadly defined PBR—a firm-by-firm breakdown is available from the author. This variation constitutes a perfect source for a panel analysis. I consider forty-six states for which data on incentive rules, rates, average costs and proxies for the determinants of incentive rules are available (see the Appendix). Besides, from 1996 on, a wide deregulation and competition-enhancing process, which came into force with either one or two years lag, has interested the market. Such a restructuring wave has dramatically altered the strategic environment (see, for a theoretical explanation, Laffont and Tirole, [1993], ch. 17). An inference unable

[24] The prediction is similar to those obtained by the Alesina and Tabellini (1990) and Hanssen (2004). Yet, PBR not only limits the options of successors—as fiscal deficits and appointed courts do—but it also ties the incumbent's hands later on, when electoral promises need to be met.

to disentangle the fine details of the liberalization can be highly misleading, so I limit my analysis to the 1982-1997 period.[25] During these years, three alternatives to cost of service have been used: rate case moratoria, earnings sharing and price cap. While the former constitute agreements to freeze the firm's rates during a commitment period, earnings sharing contracts require the firm to share earnings above and below an intermediate range with its users. When earnings are in the range, the firm secures for herself greater profit only if a higher cost-reducement effort is exerted. Under price cap, finally, the firm acts as residual claimant of its performance and can adjust its rates as long as on average they rise no faster than inflation less a productivity offset. Thus, price cap is the most powerful rule, cost of service is the least powerful and the others lie in between the two extremes.

IV.A Non Random Incentive Rules Selection

Once a comparable sample of institutions that vary in their effects on the power of incentive rules has been identified, I need proxies for the determinants of incentive rules and a suitable empirical strategy. Let me start from the latter.

Empirical strategy.—In order to exploit the three-dimensional variation—over time and across both states and power levels—in incentive rules, I estimate three models. While the first two look at the determinants of the likelihood of reforms, the third one focuses on the relative timing. The first model is the ordered logit:

$y_{i,t} = k$ if $\tau_{k-1} \leq y^*_{i,t} < \tau_k$ for $y^*_{i,t} = \varpi' z_{i,t} + \varepsilon_{i,t}$ and $k = 1, 2$,

which can be expressed in terms of the conditional distribution of $y_{i,t}$ given $z_{i,t}$ as

[25] Adding restructuring dummies or considering a sample with one or two more or less years does not affect the empirical results discussed below in any appreciable way.

$$\Pr\left(y_{i,t}=k\left|z_{i,t}\right.\right)=\Lambda\left(\tau_k-\varpi' z_{i,t}\right)-\Lambda\left(\tau_{k-1}-\varpi' z_{i,t}\right),$$

where τ_k are the unknown threshold parameters, Λ is the logit function and $y_{i,t}$—*PBR_O* —equals one if state i was using cost of service in year t, three if price cap was in use and two if another procedure was employed.[26] $z_{i,t}$ collects the eventually time-varying proxies for the the strength of implicit incentives and intrinsic motivations, for the efficiency of the information-gathering technology, for society's investment concerns, and for the incumbent's hold on power.[27] In order to deal with the endogeneity of some proxies, I will also run an instrumental variable probit with dependent equal to 1 in year t if at least one firm in the state was adopting some form of performance based regulation and 0 otherwise—*PBR*.[28] The latter is also the dependent of the exponential proportional hazard rate

$$\lambda\left(t,z_{i,t}\right)=\exp\left(\omega' z_{i,t}\right)\tilde{\lambda}_t,$$

with baseline hazard $\tilde{\lambda}_t$ and instantaneous probability of reforming from cost of service to some kind of performance based regulation $\lambda\left(t,z_{i,t}\right)$.

Measuring the structural determinants of incentive rules.—Starting from the first prediction, implicit incentives can be summarized by an elected judges dummy—

[26] The nonlinearity of the optimal contract suggests a role for interacted regressors. If I estimate a logit model with dependent *PBR* and I consider an interaction term at the time, the latter is usually not significant at a probability of the reform level of 0 and 0.5 (see Ai and Norton, [2003]).

[27] The embraced empirical strategy is essentially driven by the lack of within variation in many controls. However, the coefficients attached to the time-varying covariates are qualitatively similar when a fixed effects logit is run. Clustering the standard errors does not affect the analysis.

[28] If I use the single IOUs within a state as the cross sectional identifiers, none of the results is affected. Similarly, switching to an ordered probit, imposing a different duration distribution or running a logit or probit model with dependent *PBR* does not change the main message.

Jud_Elec, and an elected regulators binary—*Reg_Elec*. As shown in Guerriero (2009), implicit incentives are driven by the same battery of rent-seeking and efficiency forces. If the proxies introduced below capture all these determinants, it could be claimed that both *Reg_Elec* and *Jud_Elec* are conditionally independent to the choice of incentive scheme. Yet, this assumption is difficult to maintain and, thus, I will instrument *Reg_Elec* (*Jud_Elec*) with the share of neighboring states electing PUC commissioners (High Court Judges)—*Ereg_Nei* (*Ejud_Nei*), and with the year the state joined the union. While the latter is clearly exogenous and is meant to control for the overall quality of the state institutions (Persson and Tabellini, 2003), the other instruments are related to the learning component of the institution diffusion (Ka and Teske, 2002). Indeed, after a state has adopted a new policy, surrounding states are more likely to follow suit. In this case, the exogeneity is assured by the following argument developed by Steiner (2004): while the presence of low prices in reforming neighbouring states could shift support for reform, in state i rates do not adjust until the reform is implemented.

A more challenging task is finding proxies for intrinsic motivations. For what concerns fairness motivations, a wide literature on judicial independence (see Hanssen, [2004]) claims that longer judicial terms assure more insulation, and dilute reputational concerns. Thus, the length of judicial term—*Jud_Term*—should proxy for less powerful fairness motivations. Turning to revolving door motivations, I follow Teske (2004) and I use a binary variable equal to one if the PUC imposes restrictions on how long, after service, a commissioner must wait before taking a job in the industry and 0 otherwise—*Rev_Door*. This control can proxy for weaker or stronger pro-industry motivations depending on whether or not the loss of attractiveness of future job opportunities dominates the incentive to

implement more biased decisions to signal an interest for the industry.[29] Both *Rev_Door* and *Jud_Term* have no time variation over my sample, and display patterns similar to those discussed below when instrumented with the share of neighbouring states adopting them.

Focusing on the second prediction, it is reasonable to assume that more abundant resources ease information gathering. Thus, I add to the other controls the total budget in thousands of dollars available to the PUC's staff—*Budget*. This sum is set at the state level in order to be comparable with similar bureaucracies and, thus, fairly exogenous to the reform wave (see NARUC, [1982-1997]). I also need to measure society's investment concerns. To this extent, I follow Steiner (2004), and I posit that higher residential prices increase among consumers the saliency of contract encouraging cost-reducing investments. Given that state by state partial autocorrelation functions suggest that the residential price is an autoregressive of order one process, in order to avoid simultaneity, I include prices—i.e., revenue in cents per Kwh —lagged two periods—*Price_R(-2)*.

Testing the last prediction requires a proxy for the reformer's constituency ideology. A broad consensus (Ka and Teske, 2002; Teske, 2004) holds that the Republican Party has been historically supported by shareholders lobbies. This suggests that a time dummy for the years in which both houses were under the control of the Republicans—*Rep*—should control enough accurately for more pro-shareholders incumbent's sentiments. Finally, in order to capture the strategic dynamics, I follow Hanssen (2004) and I employ as a proxy for how strong the

[29] Similar crowding effects have been widely documented in environments where implicit and intrinsic motivations interact: Bénabou and Tirole (2006) provide a first full-fledged theory. I thank David Ulph for drawing my attention to this particular point.

incumbent's hold on power is the share of seats held by the majority party averaged across upper and lower houses—*Majority*. A bundling argument assure that these two covariates are exogenous: indeed, regulation is bundled at elections with more salient policies, and so politicians have no costs from biased regulatory decisions (see Besley and Coate, [2003]). Finally, I include as extra controls the share of surrounding states adopting PBR—*PBR_Nei*, the state population—*Population*, and the state income per capita in dollars—*GSP*.

Table 1 reports the descriptions and summary statistics of all the controls. Column (1) ((2)) of Table 2 lists the coefficients (marginal effects) of the ordered logit model. Column 3 of the same table reports the marginal effects of the instrumental variables probit treating. Finally, the hazard ratios of the hazard rate model are gathered in column (4) of Table 2.

Empirical results.—As clearly illustrated by columns (1) and (2) of Table 2, the power of the implemented rule and supervisors' implicit incentives display a clear strategic complementarity pattern. The commissioners' appointment rule is more relevant than the judicial one; and a reform from appointed to elected regulators implies a little more than a 5 percentage point increase in the likelihood of a reform toward price cap as the relative marginal effect in column (2) reveals. For what concerns intrinsic motivations, the results are mixed. While the coefficient attached to *Jud_Term* has the right sign but it is not statistically significant, *Rev_Door* significantly decrease the likelihood of going toward a more powerful rule, suggesting that a timing limit enhances in spite of curbing revolving door boosts (see for a similar evidence Ka and Teske, [2002]).

Turning to the second prediction, higher values of *Budget* increase both the ordered log-odds of adopting more powerful schemes and the likelihood of a

reform toward price cap. The relative coefficient is significant at 1 percent. Similarly, a one-standard-deviation increase in *Price_R(-2)*—2.082—raises the likelihood of a reform toward price cap by a 0.8 percentage points.

For what concerns the last prediction, the likelihood of a reform toward more powerful schemes is significantly—at 10%—related to a less tight political competition. The coefficient attached to *Rep*, instead, displays the correct sign but it is never statistically significant. A similar observation holds true for *PBR_Nei*.

Column 3 shows that the results discussed so far remain qualitatively similar when the implicit incentives are considered as endogenous.[30] Similarly, the evidence regarding the reforms timing is consistent with the predictions coming from the theoretical section. However, as column (4) of Table 2 shows, this time *Majority* is no more statistically significant.[31] All in all, observed institutions reflect both efficiency and forward-looking concerns.[32] This non

[30] The marginal effects in column (2) and (3) cannot be compared given the different structures of the two models. The first stage in column (3) confirms that the instruments are highly correlated with the endogenous covariates, and such that *Ereg_Nei* (*Ejud_Nei*) explain only *Reg_Elec* (*Jud_Elec*). This avoids that the measurement error in one proxy does load on the other one.

[31] The reported figures are hazard ratios, and a coefficient greater than 1 implies higher odds that an individual in the treatment group implements the reform before an individual in the control group. Thus, for instance, a state selected at random from the group of states electing their PUC commissioners has an 84.2 percent (= 5.33/(5.33+1)) higher probability of implementing the reform before a state selected at random from the group of states appointing their commissioners.

[32] Using deflated prices or including income per capita, population, proportion of young and old citizens, regional dummies, the share of production obtained through nuclear and hydroelectric sources, the share of customers who are residential, commercial or industrial, the number of full time employees, the salary of commissioners and the ratio of each state price over the mean of that prevailing in surrounding states does not affect the main results.

random assignment of reforms to US states not only confirms the model's ideas but also implies that the effect of incentive rules on performance can be assessed correctly only when these institutions are treated as endogenous: I perform this empirical exercise in the next section.

IV.B Regulatory Performance and Endogenous Incentive Rules

States may well self select into PBR on the bases of unobserved political and technological shocks affecting at the same time the cost structure and the political and social saliency of the reform. If the variation in incentive rules used to explain prices is related to these unexplained determinants of performance, the OLS estimator becomes biased.

Empirical methodology.—In order to assess correctly the effect of PBR, I estimate the following dynamic panel model:

$$y_{i,t}^{s} = \eta_i + \vartheta_t + \theta y_{i,t-1}^{s} + \phi PBR_{i,t} + \varphi X_{i,t} + \varepsilon_{i,t}, \qquad (10)$$

using the Arellano-Bond difference GMM estimator. $y_{i,t}^{s}$ is a price in state i and year t for customer class s. The classes considered are: residential—*Price_R*, commercial—*Price_C*, and industrial—*Price_I*. $y_{i,t-1}^{s}$ is a lagged performance term and picks up the persistence in the pricing process.[33] $X_{i,t}$ is a vector of factors likely to influence regulation. They are the time-varying determinants of incentive regulation discussed above—*Reg_Elec*, *Jud_Elec*, *Budget*, *Republican*,

[33] Friedman (1991) claims that past prices constitute crucial benchmarks for the PUC staff (see Ai and Sappington, [2002]). Yet, the temporal structure implicit in the estimated model is not general. The effects of PBR may not materialize until several years after implementation. Replacing *PBR* with its counterparts lagged one year produces results similar to the findings reported below.

Majority, a fossil fuels costs index—*c*—devised by Besley and Coate (2003), state population—*Population*, share of population aged between five and seventeen—*Young*—and sixty-five and over—*Old*, and state income per capita in dollars—*GSP*. Even after controlling for these factors, some relevant systematic variation inevitably remains, thus I introduce both state—η_i—and time—ϑ_t—dummies. While the former captures time-invariant features of the regulated environment such as state laws and long-run differences in production systems, the latter pick up macro-shocks such as interest rates shocks, changes in federal policies and industry wide technological advances. *PBR* captures incentive rules. Estimating the model in difference avoid the well-know "dynamic panel bias" driven by the correlation between $y^s_{i,t-1}$ and the past errors and, therefore, the de-meaned errors $\varepsilon_{i,t} - \overline{\varepsilon}_i$ (see, for details, Baltagi [1995], ch. 8).

I treat $y^s_{i,t-1}$ as predetermined and c as endogenous: treating both as endogenous does not affect the main message of the estimates discussed below. State by state partial autocorrelation functions suggest that c should be treated as an autoregressive of order one process. Therefore, I introduce only one lag of $y^s_{i,t-1}$ and *c* in the collapsed instruments matrix: this also helps avoiding an over-instrumentation failure.[34] I also add *PBR_Nei* as exogenous instrument. Similar results are obtained when I use, instead, an indicator for the contemporaneous use of incentive regulation in the state telecommunications sector. Finally, I always

[34] The instruments count tends to explode with the number of years *T*, and too many moment conditions can overfit endogenous variables failing to expunge their endogenous component, and weakening the power of the Hansen test for overidentification restrictions. The strategy that I adopt here reduces the instrument count well below the number of cross sections: this is a "rule of thumb" precaution against the "too many instruments" failure (see Roodman, [2006]).

apply the Windmeijer finite-sample correction to the robust standard errors in order to avoid downward biases (see Roodman, [2006]).

Empirical results.—The basic results are given in Table 3. The Arellano and Bond (1991) autocovariance test does not reject a zero second-order correlation in the differenced residuals at a level nowhere lower than 0.54. Similarly, the Hansen test does not reject the over-identifying restrictions at a level nowhere lower than 0.46. These tests reassure about the consistency of the estimates. Focusing on *PBR*, columns (1) to (3) clearly show that the introduction of PBR had a negative (positive) but insignificant effect on commercial (residential and industrial) ratepayers. The result could be driven by the lack of a sufficiently long sample or could just imply that many of the reforms were mainly implemented—as section III.C suggests—to accommodate dynamic investment concerns after an era of rising input costs and fierce consumers opposition to price adjustements. This last explanation is supported by the fact that I find a zero impact of PBR on fossil fuels costs and mark ups for the same time period using the same dynamic GMM model—not reported.

V. Concluding Remarks

The relevance of regulatory institutions to economic development is key especially in a period of deregulation and competition-enhancing reforms. Yet, the determinants of incentive contracts are still not completely understood: in this paper, I developed and tested a model of endogenous pricing rules. Given the overall technology environment, the strength of supervisors' implicit incentives and intrinsic motivations, political reformers not only have taken into account the

comparative advantages of different incentive schemes, but they have also used PBR to tie the hands of rival parties when uncertain about re-election. Consistent with the model, the likelihood of reforms toward higher powered rules has been linked to elected regulators, a less stringent PUC budget constraint, a more expensive electricity generation, and a stronger incumbent's hold on power.

Even if several states have recently tried to enhance competition, many US major utilities are still regulated through settings similar to those studied above. Besides, similar institutions have been exported beyond American boundaries as an answer to the rising demand for a more effective judicial review and for a greater transparency of the regulatory process (see Newbery, [2000], ch. 2). This institutional trend makes the US lesson an increasingly relevant case study, especially useful for the future harmonization of European regulated markets.[35] To the latter extent, my analysis delivers three pieces of advice for constitutional designers: 1. It is crucial to assess carefully the dynamic effects of more powerful rules when expropriation of sunk investment is a concern; 2. Before calibrating the firm's explicit incentives, the efficiency of the information-gathering and production technology, and the broad set of concerns to which public officials respond need to be considered attentively; 3. The success of regulatory reforms is linked to a Constitutional table insulated from short-term electoral boosts.

[35] As stressed by Motta (2004) and Breyer (2009), several recent antitrust cases—e.g., Ahlstrom versus European Commission, 1993 and Enel versus Wind-Infostrada, 2002—have focused the interest of several European countries on the "gate-keeper" role of administrative judges.

VI. Appendix

Equilibrium under Perfect Information

Under perfect information, the planner knows β and infers a from the observation of c. The first best contract, obtained maximizing (2) with respect to a, U and q, prescribes that:

1. The disutility of effort is equalized to the cost reduction at the margin:

$$\psi'\left(a^*\right)=q^*; \qquad (A1)$$

2. Given the existence of the shadow cost of rewards, no rent is left to the firm:

$$U=0 \qquad \text{or} \qquad t^* \equiv \psi\left(a^*\right);$$

3. The social marginal value of output and its marginal cost are equalized:

$$V'\left(q^*\right)=(1+\lambda)\left(\beta-a^*\right) \qquad \text{or} \qquad S'\left(q^*\right)=p^*=c.$$

A fixed price contract on the managerial reward t gives the firm the right incentives for cost reduction. Label $T \equiv \psi\left(a^*\right)$ and $C^* \equiv \left(\beta-a^*\right)q^*$, equilibrium managerial rewards are $t^*\left(C^*\right)=T-\left(C(q)-C^*\right)$. The planner tailors the fixed charge T to fully extract the firm's rent, and the firm, which is left as the residual claimant of its cost savings, maximizes $T-\left((\beta-a)q-C^*\right)-\psi(a)$ and, consequently, chooses the optimal a. ■

Proof of Lemma

Let me first characterize the effort exerted in equilibrium by elected supervisors. Maximizing $\tilde{R}_{E,l}\left(e_{E,l},S\right)$ with respect to $e_{E,l}$ with $e_{E,l}^{\exp}$ taken as given and, then, imposing the equilibrium condition $\hat{e}_{E,l}=e_{E,l}^{\exp}$, such effort is defined by

$$LHS\left(\hat{e}_{E,l}\right) \equiv (1-SR)\,f\left(\bar{\alpha}\right)\left(\bar{\alpha}/\hat{e}_{E,l}\right)-\left(1-(1-S)J\right)(1-K)\tilde{C}'\left(\hat{e}_{E,l}\right) \le 0, \qquad (A2)$$

and by the slackness conditions $\left(\hat{e}_{E,l}-1\right)LHS\left(\hat{e}_{E,l}\right)=0$ and $\hat{e}_{E,l}LHS\left(\hat{e}_{E,l}\right)=0$. In the $\left\{\hat{e}_{E,l},R_{E,l}\left(e_{E,l},S\right)\right\}$ space, the first term in $LHS\left(\hat{e}_{E,l}\right)$ is a rectangular hyperbola centred in $(0,0)$ while the second term is an increasing function. This, along with the fact that $\tilde{C}'(0)<\infty$ and $\lim_{e_{i,l}\to 1}\tilde{C}'\left(e_{i,l}\right)=\infty$, assures that $\hat{e}_{E,l}$ exists and is both interior and unique. Turning to appointed supervisors and following the treatment in Dewatripont, Jewitt and Tirole (1999), equilibrium efforts are implicitly defined by the following first order condition

$$(1-SR)\mathrm{E}\left[\alpha f_{e_{A,l}}\left(\xi_{A,l}\middle|\hat{e}_{A,l}\right)\middle/f\left(\xi_{A,l}\middle|\hat{e}_{A,l}\right)\right]\leq\left(1-(1-S)J\right)(1-K)\tilde{C}'\left(\hat{e}_{A,l}\right). \qquad (A3)$$

Again $(A3)$ holds as an equality—and thus the slackness conditions are always met. The marginal density of the observable conditional on effort $f\left(\xi_{A,l}\middle|\hat{e}_{A,l}\right)$ is proportional to $\exp\left[-(1/2)\left(\xi_{A,l}-\bar{\alpha}e_{A,l}\right)^2\left(e_{A,l}^{\exp}\sigma_\alpha\right)^{-2}\right]$ if f is the truncated normal and equal to $\hat{e}_{A,l}f(\alpha)$ if f is one of the other distributions in the relevant class. Thus, from the equilibrium condition $\hat{e}_{A,l}=e_{A,l}^{\exp}$, it follows that $\mathrm{E}\left[\alpha f_{e_{A,l}}\left(\xi_{A,l}\middle|\hat{e}_{A,l}\right)\middle/f\left(\xi_{A,l}\middle|\hat{e}_{A,l}\right)\right]=\bar{\alpha}/\hat{e}_{A,l}$ and $(A3)$ can be rewritten as

$$(1-SR)\left(\bar{\alpha}/\hat{e}_{A,l}\right)=\left(1-(1-S)J\right)(1-K)\tilde{C}'\left(\hat{e}_{A,l}\right). \qquad (A4)$$

$(A2)$ and $(A4)$ clarify that: 1. Elected supervisors exert a strictly greater effort than appointed ones if $f(\bar{\alpha})>1$—which is always true under A1; 2. Supervisors' objective functions are strictly concave and the following three global comparative statics apply: $\partial\hat{e}_{i,R}/\partial R<0$, $\partial\hat{e}_{j,J}/\partial J>0,\forall j$, $\partial\hat{e}_{i,l}/\partial K>0,\partial\hat{e}_{j,l}/\partial K>0\forall i,j,l$. ■

Underinvestment When the Planner Cannot Commit

As in Laffont and Tirole (1993), the socially optimal I minimizes the sum of investment costs and ex post costs:

$$I^* \in \arg\min_{I\geq 0}\left\{Iq\left(\hat{I}\right)+v\left(1+\zeta\left(I\right)\right)\underline{\beta}q\left(\hat{I}\right)+\left[1-v\left(1+\zeta\left(I\right)\right)\right]\bar{\beta}q\left(\hat{I}\right)\right\}. \qquad (A5)$$

This amounts to saying that the objective in $(A5)$ assumes a value greater at $\hat{I}$ than at I^*; the same can be said for the function in (7). As a result, it follows that

$$\hat{I}q\left(\hat{I}\right)+\bar{\beta}q\left(\hat{I}\right)-v\left(1+\zeta\left(\hat{I}\right)\right)\Delta\beta q\left(\hat{I}\right)+v\left(1+\zeta\left(\hat{I}\right)\right)\left[1-\gamma\left(i,j\right)\right]\Phi\left(\hat{\tilde{a}}^{S,I}\left(\hat{I}\right)\right)-\hat{I}q\left(\hat{I}\right)\geq$$

$$I^*q\left(\hat{I}\right)+\bar{\beta}q\left(\hat{I}\right)-v\left(1+\zeta\left(I^*\right)\right)\Delta\beta q\left(\hat{I}\right)+v\left(1+\zeta\left(I^*\right)\right)\left[1-\gamma\left(i,j\right)\right]\Phi\left(\hat{\tilde{a}}^{S,I}\left(\hat{I}\right)\right)-I^*q\left(\hat{I}\right)\Rightarrow$$

$$v\left(\zeta\left(I^*\right)-\zeta\left(\hat{I}\right)\right)\left\{\Delta\beta q\left(\hat{I}\right)-\left[1-\gamma\left(i,j\right)\right]\Phi\left(\hat{\tilde{a}}^{S,I}\left(\hat{I}\right)\right)\right\}\geq 0. \qquad (A6)$$

Given that $\zeta'\geq q\left(\hat{I}\right)\left(v\Delta\beta\right)^{-1}$, $\zeta''<0$ and $\lim_{I\to\bar{\bar{I}}}\zeta'\left(I\right)=\infty$, the solutions to $(A5)$ and (7) are interior—so that the slackness conditions are always met—and such that

$$\left[1-\gamma\left(i,j\right)\right]\Phi\left(\hat{\tilde{a}}^{S,I}\left(\hat{I}\right)\right)=q\left(\hat{I}\right)\left[v\zeta'\left(\hat{I}\right)\right]^{-1}\leq\Delta\beta=\left[v\zeta'\left(I^*\right)\right]^{-1}; \qquad (A7)$$

where I have imposed the first order conditions and used, once again, the fact that $\zeta'\geq q\left(\hat{I}\right)\left(v\Delta\beta\right)^{-1}$. Clearly $(A7)$ implies that $\zeta'\left(I^*\right)\leq\zeta'\left(\hat{I}\right)\Leftrightarrow I^*\geq\hat{I}$ by the concavity of the ζ function. Withal, also $(A6)$ holds. ■

Proof of Proposition 3

Applying the implicit function theorem to (9), it follows that $\partial\hat{\tilde{a}}^{S,I}_{\tilde{m}}/\partial\chi_{\tilde{m}}<0$, which proves the second bit of Proposition 3 being $\chi_R=1+o-\theta<\chi_D=1+o+\theta$, and that $sign\left\{\partial\hat{\tilde{a}}^{S,I}_{\tilde{m}}/\partial x_{\tilde{m}}\right\}=sign\left\{\partial\tilde{x}\left(1+o-\chi_{\tilde{m}}\right)/\partial x_{\tilde{m}}\right\}$. As a result, the following two derivatives conclude the proof:

$$\partial\tilde{x}\left(1+o-\chi_R\right)/\partial x_R=\theta\left(\rho_R-\rho_D\right)=-\theta\left(\rho_D-\rho_R\right)=\partial\tilde{x}\left(1+o-\chi_D\right)/\partial x_D>0. \qquad ■$$

Data

The data set gathers observations for 46 states over the period 1980-1997. Only a few data points are available for the District of Columbia and no data on PBR are available for Alaska, Utah and Wyoming. No major IOUs serve Nebraska. The variables sources are:

1. Data on incentive schemes are collected directly from:

A. Basheda et al. (2001); B. EEI, *Performance Based Regulation: EEI Member Survey* (Washington, DC: EEI, 2000).

2. Data on sales, revenue, generation shares and the price of fossil fuels composite per net Kwh are calculated from the EEI—Edison Electric Institute—yearbook:

A. EEI, *1960 – 1992: Historical Statistics of the Electric Utility Industry* (Washington, DC: EEI, 1995).

B. EEI, *Statistical Yearbook of the Electric Utility Industry* (Washington, DC: EEI, 1993-1997).

EEI refers to the source of data for its yearbooks to various places including DOE, EIA, Federal Power Commission and FERC. EEI reports annual revenues in dollar terms and sales in Kwh by state and class of service. Residential, commercial and industrial users account for the 95 percent of revenues. EEI reports electric generation and sources of energy for generation in two types of breakdown: i.e., by type of prime mover driving the generator and by energy source. The totals from the two of them are consistent. I used the second one, except for generation by hydro (see also Besley and Coate, [2003]). Prices are calculated from the revenues and sales in terms of cents per Kwh.

3. Political preferences are from the Council of State Governments—yearbooks:

CSG, *The Book of the States* (CSG, Lexington, KY, 1982-1997).

4. Data on regulatory selection rules, revolving door restrictions, bipartisanship requirements, and total budget are collected from: A. PUCs' web pages;

B. NARUC, (1982-1997).

5. Data on judicial selection rules and length terms are collected from:

A. Hanssen, F. A., "Learning About Judicial Independence: Institutional Change in the State Courts," *Journal of Legal Studies*, XXXIII (2004), 431-474, table 1.

B. Besley, T., and Payne, A., "Implementation of Anti-Discrimination Policy: Does Judicial Selection Matter?" Working Papers, LSE, 2005, table 1.

6. In order to construct the fossil fuel cost index, let s_{ijt} and q_{ijt} be, respectively, the share and price of input j—coal, gas and oil—for state i and year t. So, if $p_{it} \equiv \sum_j q_{ijt} p_{ijt} / q_{it}$ is the average price of fossil fuels composite per net Kwh for state i in year t, then the cost index is defined as $c_{it} = s_{it} p_{it}$.

7. State income per capita, population, proportion aged over 65 and proportion aged 5–17 are calculated from a US Census Bureau—UCB—publication:

UCB, *Population Estimates Program* (Washington, DC: UCB, 1980-1997).

8. State income per capita is collected directly from a UCB publication: UCB, *Statistical Abstract of the United States* (Washington, DC: UCB, 1980-1997).

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Tables

Table 1: Variable Names and Descriptions

	Variables	Description	Mean (Standard Deviation)
Incentive schemes:	*PBR*:	Dummy taking value 1 if in the state a PBR contract is in use; 0 otherwise.	0.080 (0.272)
	PBR_O:	Dummy taking value 3 if in the state a price cap contract is in use; 1 if cost of service is employed and 2 otherwise.	1.115 (0.416)
Supervisors' implicit incentives:	*Reg_Elec*:	Dummy taking value 1 if commissioners are elected; 0 otherwise.	0.217 (0.413)
	Jud_Elec:	Dummy taking value 1 if High Court judges are elected; 0 otherwise.	0.482 (0.500)
Supervisors' intrinsic motivations:	*Rev_Door*:	Dummy equal 1 if there is a time restriction on commissioners working for the regulated industry once they have left the PUC; 0 otherwise.	0.652 (0.477)
	Jud_Term:	Length of High Court judges' term in years.	8.761 (3.082)
Supervision technology:	*Budget*:	PUC's total receipts in thousands of dollars.	18382.94 (34828.78)
Investment Concerns:	*Price_R(-2)*:	Revenue—cents per Kwh—from sales to residential users lagged two years.	7.241 (2.082)
Political competition:	*Republican*:	Dummy taking value 1 if both houses are controlled—with the absolute majority of seats—by the Republican party; 0 otherwise.	0.365 (0.482)
	Majority:	Percentage of seats—averaged across upper and lower houses—held by the majority party.	0.651 (0.118)
Prices:	*Price_R*:	Revenue—cents per Kwh—from sales to residential users.	7.595 (2.109)
	Price_C:	Revenue—cents per Kwh—from sales to commercial users.	6.897 (1.803)
	Price_I:	Revenue—cents per Kwh—from sales to industrial users.	4.918 (1.526)
Average costs:	*c*:	Cost of fossil fuels in cents per Kwh.	1.233 (0.940)
Other controls:	*PBR_Nei*:	Share of neighbouring states using PBR.	0.075 (0.150)
	Population:	State population.	5,318,228 (5,476,011)
	Old:	Percentage of population aged 65 and over.	0.126 (0.017)
	Young:	Percentage of population aged 5–17.	0.188 (0.015)
	GSP:	Gross state product per capita in dollars.	15975.28 (5369.74)
Instruments:	*Ereg_Nei*:	Share of neighbouring states electing public utility commissioners.	0.149 (0.236)
	Ejud_Nei:	Share of neighbouring states electing their High Court judges.	0.494 (0.316)
	Join:	Year the state joined the Union.	1834.304 (44.182)

Table 2: Non Random Incentive Schemes Selection

	(1)	(2)	(3)	(4)
	The Dependent Variable is:			
	PBR_O	*PBR_O = 3*	*PBR*	*PBR*
Reg_Elec	2.353 (0.368)***	0.055 (0.013)***	0.166 (0.034)***	5.328 (3.417)***
Jud_Elec	0.080 (0.298)	0.001 (0.003)	0.004 (0.013)	0.562 (0.315)
Rev_Door	– 0.893 (0.345)***	– 0.011 (0.005)**	– 0.033 (0.015)**	0.554 (0.407)
Jud_Term	– 0.082 (0.063)	– 0.0008 (0.0007)	– 0.0039 (0.003)	1.106 (0.116)
Budget	0.00002 ($4.47e^{-06}$)***	$2.08e^{-07}$ (0.00000)***	$6.43e^{-07}$ (0.00000)***	1.00001 ($4.44e^{-06}$)***
Price_R(-2)	0.428 (0.159)***	0.004 (0.002)**	0.014 (0.006)**	0.878 (0.188)
Republican	0.073 (0.351)	0.0007 (0.004)	0.002 (0.014)	0.625 (0.446)
Majority	2.527 (1.416)*	0.025 (0.013)**	0.092 (0.057)*	6.281 (15.581)
PBR_Nei	0.328 (0.956)	0.003 (0.010)	0.010 (0.043)	7.779 (12.637)
Population	$7.17e^{-08}$ ($2.72e^{-08}$)***	$7.22e^{-10}$ (0.00000)***	$2.25e^{-09}$ (0.00000)	1 ($2.71e^{-08}$)*
GSP	0.0001 (0.00004)**	$1.02e^{-06}$ (0.00000)**	$4.59e^{-06}$ (0.00000)***	1.0002 (0.00007)**
Estimation	Ordered logit.		IV Probit.	Exponential survival.
Endogenous			*Reg_Elec*, *Jud_Elec*	
Instruments			*Ereg_Nei*, *Ejud_Nei*, *Join*	
Exogeneity Test			0.89	
Log Likelihood				– 22.365
Log Pseudolikelihood	– 183.300		– 802.741	
Pseudo R^2	0.25			
Number of Observations	736		736	692

Notes: 1. Robust standard errors—z distribution—in columns (1) and (2) parentheses;
standard errors in the parentheses of column (3);
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%;
3. The entries in column (3) are hazard ratio estimates.
4. In the exogeneity test row the *p-value* of a joint test of a zero covariance between the two reduced form equations' errors and the structural equation's error is reported.

Table 3: Effects of PBR on Regulated Rates

	(1)	(2)	(3)
	The Dependent Variable is:		
	Price_R	*Price_C*	*Price_I*
PBR	0.126 (0.214)	– 0.100 (0.163)	0.093 (0.139)
Other Controls	*Reg_Elec*, *Jud_Elec*, *Budget*, *Republican*, *Majority*, *Population, Young*, *Old*, *GSP*.		
Predetermined	*Lagged dependent variable*		
Endogenous	*c*, *PBR*		
Instruments (collapsed)	*One lag of predetermined and of c*, *PBR_Nei*		
Estimation	Fixed state and time effects difference GMM estimator.		
Instruments count	28	28	28
Autocov. of order 2	0.74	0.54	0.68
Hansen test for overid. Restrictions	0.90	0.46	0.67
Number of observations	644	644	644

Notes: 1. Standard errors in parentheses;
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.