POLITICIANS, INTEREST GROUPS, AND REGULATORS: A MULTIPLE-PRINCIPALS AGENCY THEORY OF REGULATION, OR "LET THEM BE BRIBED"*

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I. INTRODUCTION

THE main thrust of the self-interest theory of regulation, as proposed by Stigler and Peltzman,[1] is that regulations develop as the result of demands from different interest groups for governmental intervention. There is no necessary divergence between politicians' optimal policies (as responses to interest groups' demands) and their implementation. Policies, however, are seldom implemented directly by the politicians themselves. Instead, they are delegated to regulatory agencies, departments, or the courts. In this article, I expand the self-interest theory of regulation to account for the potential agency problems between Congress and its regulators, and I subject the implications of the agency part of the framework to a preliminary empirical test.

Agency problems between politicians and regulators arise because regulators' actions are intrinsically unobservable. Thus, congressional (or

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[1] Sam Peltzman, Toward a More General Theory of Regulation, 19 J. Law & Econ. 211 (1976); George J. Stigler, The Theory of Economic Regulation, 2 Bell J. Econ. & Mgmt. Sci. 3 (1971).

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presidential) delegation of regulatory authority generates agency discretion. Regulators, then, may pursue interests not aligned with those of the politicians who appoint them.[2] This insight has not gone unobserved by students of the political economy of regulation. Two main approaches have developed. One, coined the "Congressional Dominance" hypothesis, while recognizing the potential agency problems between Congress and its regulators, essentially assumes that congressional instruments are powerful enough to fully control its regulators.[3] The other approach, embedded in the naive capture or bureaucratic theories of regulation, implicitly assumes that agency problems are so acute that bureaucracies can work independently of congressional or presidential desires.[4] In this article, these two approaches are seen as particular (corner) solutions to a more general agency problem, where politicians and interest groups compete to influence regulators' decisions.[5]

I focus on congressional delegation of regulatory authority.[6] While the interests of congressmen and interest groups are related, they do not

[2] Throughout this article I will assume that congressional interests are well defined. This assumption would hold if, as will be the case here, the policies of the regulatory agency are unidimensional. If policies were multidimensional, then Congressional interests might not be well defined, and delegation of regulatory authority might in itself provide substantial scope for regulators pursuing their own interests. On this issue, see T. H. Hammond, J. S. Hill, & G. J. Miller, Presidential Appointment of Bureau Chiefs and the "Congressional Control of Administration" Hypothesis (mimeographed, Michigan State University, 1985).

[3] While implicit in Stigler, *supra* note 1, and Peltzman, *supra* note 1, this assumption appears explicitly in, among others, Barry Weingast, The Congressional-Bureaucratic System: A Principal-Agent Perspective (with Applications to the SEC), 44 Pub. Choice, 147 (1984); and Barry Weingast & M. J. Moran, Bureaucratic Discretion or Congressional Control? Regulatory Policymaking by the Federal Trade Commission, 91 J. Pol. Econ. 765 (1983). See T. M. Moe, Congressional Control of the Bureaucracy: An Assessment of the Positive Theory of Congressional Dominance (unpublished manuscript, Brookings Institution, 1985, for a critique of the congressional dominance hypothesis. While the congressional dominance hypothesis deals, naturally, with the role of Congress in the implementation of regulatory policy, this approach can be extended to other political institutions (for example, the relation between the president and the department secretaries).

[4] See, for example, William A., Niskanen, Jr., Bureaucracy and Representative Government (1971); or K. W. Clarkson & T. J. Muris, The Federal Trade Commission since 1970: Economic Regulation and Bureaucratic Behavior (1981).

[5] The unobservability of regulators' actions implies that regulators may shirk for two reasons. First, since regulators may dislike effort, they may shirk in order to reduce their effort. In contrast, the existence of an interest group not perfectly aligned with politicians' interests implies that interest groups will (implicitly or explicitly) offer compensation to the regulators for shirking. In this article I analyze the different implications of both sources of shirking.

[6] It should be clear from the outset, however, that a more complete analysis should take into account the role of the president in the appointment and control processes. For a discussion of this issue, see Randall Calvert, Matthew D. McCubbins, & Barry R. Weingast, A Theory of Political Control and Agency Discretion (unpublished manuscript, Hoover Institution, January 1987), and references therein.

necessarily coincide. The electoral connection suggests that congressmen take into account the electoral consequences of their actions.[7] Congressmen's interests, then, are related to those of a multiplicity of groups. Some may provide support through campaign contributions, while others may provide the necessary electoral support. Unless fully aligned with a particular interest group, congressmen will not pursue the interests of any single group. Interest groups, then, can influence regulatory outcomes through two channels: indirectly, through the electoral connection, and directly, by trying to influence the regulators. Hence, Congress and interest groups will usually compete for regulators' favors.

The competition for regulators' favors has several implications for the development of regulatory policies. First, since regulatory policies have nontrivial agency costs,[8] congressmen will balance those costs against the political benefits in assessing whether to undertake a certain regulatory policy. Second, competition between Congress and interest groups implies that, even if Congress's interests were exclusively aligned with a single interest group (that is, their direct constituency), the implementation of regulatory policies would take other interests into account.[9] This feature of the "agency" model presented here is what generates many of the results associated with the "self-interest" approach (that is, regulators cross-subsidize in a fashion similar to that found in Peltzman;[10] they mitigate changes in congressional demands for regulatory policies;[11] and they may make regulatory policies more proindustry in recessions and more proconsumer in booms).[12]

[7] D. R. Mayhew, Congress: The Electoral Connection (1974).

[8] The agency costs discussed here are different from the costs involved in regulating a firm with private information. See, for example, David P. Baron & Roger B. Myerson, Regulating a Monopolist with Unknown Costs, 50 Econometrica 911 (1982). Since these costs arise even in the absence of an "agency" problem between Congress and its regulators, it will be assumed in this article that the regulated firm cannot exploit private information.

[9] By assuming away the discrepancies in objectives between Congress and regulators, the traditional congressional dominance approach imposes on regulators an objective function that is characterized by some weighted average of consumer and producer interests (for example, Peltzman, *supra* note 1). See also Thomas W. Ross, Extracting Regulators' Implied Welfare Weights: Some Further Developments and Applications, 25 Q. Rev. Econ. & Bus. 72 (1985), for a method and applications to estimate the regulators' utility function weights. In contrast, the regulatory framework developed here endogenously determines the regulator's implicit weights. In this sense, this article can be seen as exploring the "black box" of Peltzman's "political-support" function.

[10] Peltzman, *supra* note 1.

[11] See Weingast & Moran, *supra* note 3, for a congressional dominance model with a similar implication.

[12] But changes in regulatory policy here are only partially the result of changes in congressional desires; they represent, rather, changes in the incentives faced by regulators. Congress, however, knowing those incentives, chooses its optimal policies accordingly.

The "agency" framework developed here has, however, particular implications for optimal regulatory budget policies and for the career path of bureaucrats, which expands the set of empirical implications of the self-interest theory of regulation. These particular implications allow a test of the relevance of the agency part in the self-interest framework. This model predicts that, to constrain regulators' actions, regulatory budgets must fall following unfavorable outcomes for Congress.[13] A second set of empirical implications is related to the career path of bureaucrats. Because of the competition between Congress and industry, it is shown that regulators demand rents. Competition for regulators' jobs, then, implies rent dissipation. Since congressmen can be seen as appointing regulators, congressmen should be able to extract those rents from potential regulators.[14,15] Congressmen may collect the proceeds of the bidding process in the form of campaign or staff work or in direct monetary contributions. Limits on campaign contributions, however, implies that "working" for congressmen may be the most common form of rent dissipation. Most regulators, then, should have some public-sector experience. Similarly, since interest groups should compensate regulators, the "agency" framework predicts that a high percentage of regulators should eventually have postcommission jobs related to the regulated industry.

Finally, since agency costs increase when interest groups can influence regulators' decisions, Congress could limit the extent by which interest groups can influence regulatory outcomes. I present conditions, however, under which Congress prefers to allow interest groups direct influence on regulatory decisions.[16] While allowing interest groups to influence regula-

[13] This result formalizes the "fire alarm" approach suggested, among others, by Matthew D. McCubbins & Thomas Schwartz, Congressional Oversight Overlooked: Police Patrols vs. Fire Alarms, 28 Am. J. Pol. Sci. 165 (1984).

[14] While in principle the president appoints commissioners, Senate oversight committees have to approve the appointments. Thus, congressmen have substantial power to determine the pool from which potential appointees can be drawn.

[15] In what follows, I assume that Congress can be represented as a single agent. This assumption requires some discussion. First, since I analyze regulatory policy as single dimensional, committee majority rule would provide the rationale for this assumption. If, however, regulatory policies were multidimensional, then this assumption would not be sufficient to generate uniqueness of equilibrium. However, if Congress controls regulators through committees, then this assumption requires either some measure of coordination across congressional committees or that committees do not represent specialized constituencies. While committee members are able to capture regulators' rents through patronage, Congress as a whole has to agree to finance the agency's budget. Thus, unless committee members are drawn from a random distribution of congressmen, some coordination among committees will be required to assure congressional approval of the regulators' budgets.

[16] Recent public discussion of the "revolving door" at different governmental agencies has raised the question of whether Congress should further restrict postgovernmental employment for senior government executives, which would impose stricter limits on the

tors reduces the extent of regulatory control, interest groups' influence may actually increase Congress's overall benefit from the regulatory process by increasing regulators' rents, which are appropriated by congressmen. In this sense, interest groups' influence on the regulatory process may be seen as indirect contributions to congressmen.

The article is organized as follows. Section II presents the basic model. Section III presents the general formulation of the Congress-industry-agency problem and presents the equilibrium when Congress can perfectly monitor its regulators. This section shows that simply delegating regulatory actions to an agent with limited liability may deter Congress from achieving its most desired regulatory outcome. Section IV analyzes the regulatory equilibrium that occurs when Congress cannot observe the regulator's actions. Two alternative institutional settings are analyzed, depending on whether or not transfers by the interest group are allowed. This section also analyzes the implications of allowing regulators to bid for their regulatory positions. It is shown that the main effect of this is to allow Congress to indirectly extract rents from the regulated firm. Sections V and VI explore, in the form of an example, the incentives that Congress may have to allow transfers from the interest groups to the regulators. Section VII explores the empirical implications of the agency framework. The data and preliminary results are discussed in Sections VIII and IX, and Section X concludes the article.

II. The Model

Consider a three-player game: Congress, the interest group (which for convenience will be called "industry"), and the regulator. The model attempts to capture a situation where congressmen's interests are aligned with those of another, diffuse but electorally important, interest group (call them "consumers"). This interest group, however, is unable to directly influence the regulator's actions. Industry, in contrast, while being a concentrated group, may not be able to provide much electoral support.[17,18] It can, however, directly influence the regulator's incentives.

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ability of interest groups to influence the design and implementation of regulatory policies. See U.S. General Accounting Office, DOD Revolving Door: Relationships between Work at DOD and post DOD Employment (1986).

[17] This model does not allow direct influence of industry on congressmen. A more general model would allow industry to make contingent transfers to congressmen as well, which could take the form of contingent (or retrospective) campaign contributions. If campaign contributions must be designed in a way similar to industry's transfers to the regulators, this extra layer of agency problem may not substantially change the nature of the problem since there will still be a need for direct industry transfers to regulators.

[18] This article assumes that industry is able to perfectly solve its free-rider problem in making transfers to regulators.

Congress's and industry's payoffs are functions of the regulator's actions. The regulator's actions are unobservable, but they affect the distribution of industry price, p, which has a binary distribution with values $\{p_l, p_h\}$.[19] The probability of observing a low price (p_l) is given by $\phi(x)$, where x is the unobservable action (effort) taken by the regulator.[20] Let $\phi'(x) > 0$. No regulation is equivalent to the regulator taking no regulatory action; that is, $x = 0$. In that case, the industry will charge p_h with probability one. Congress is assumed to prefer a low price, while industry prefers a high price. Given the form of the probability function $\phi(x)$, Congress's (industry's) preferences are increasing (decreasing) in x. Let Congress's preferences be given by consumer surplus minus the regulator's budget, and industry's preferences by profits net of transfers.

While this article uses as an example price regulation, the model is more general. The model could be directly applied to the analysis of nonprice regulation, like pollution control, or the regulation of safety in the workplace. The main requirement of the model is that Congress's preferences should not coincide with those of the interest group.[21]

Congress and industry try to influence the regulator's choice of x. Congress's sole instrument is assumed to be the regulator's budget, which can be made contingent on the observed regulatory outcome (in our case, the price).[22] Similarly, industry's single instrument is a direct transfer to the regulator, which may also be contingent on the observed price.[23]

[19] The regulator's actions can be thought of as avoiding price collusion among the firms or as monitoring their books. More effort implies that there is a higher probability of finding, say, collusion and hence of reducing the industry price to a lower level. Since this article does not deal with the use of private cost information by the industry, the analogy to cost regulation is only heuristic.

[20] In this model, x is unobserved by both Congress and industry. This assumption could be relaxed by letting industry have better information about x than Congress (that is, industry could observe a signal of x). While this assumption would make the model more realistic, it would increase its complexity without adding substantial new insights.

[21] Notice also that, since budgets enter into congressmen's preferences, the opportunity cost of a dollar is exactly one. Thus, there is a real utility cost for congressmen in providing large budgets to their regulatory agencies.

[22] The budget concept that I use here is the discretionary rather than the operational budget. The latter should also affect regulatory efficiency. That is, ϕ could, in principle, depend on the level of operational budget. Here it is assumed that ϕ depends only on the regulator's action x.

[23] For example, industry transfers could take the form of postgovernment employment. While I restrict industry's influence instrument to direct transfers, regulated industries may also use other methods to influence regulators. Bruce M. Owen & Ronald Braeutigam, The Regulation Game: Strategic Use of the Administrative Procedure (1978), analyze how regulated industries use administrative procedures to influence regulatory outcomes. In particular, by threatening to obstruct regulatory proceedings, the regulated industry may be able to provide incentives to the regulator to undertake favorable regulatory actions.

For any set of budgets and industry transfers, the regulator chooses the optimal action x (effort level), which in turn determines his expected utility. The regulator's utility function is assumed to be increasing in budgets and transfers, decreasing in the action x (effort), and separable in budgets, effort, and income (namely, industry's transfers).

The timing of the game between Congress, industry, and the regulator is as follows. First, Congress decides whether to allow industry transfers to the regulator. While in principle Congress could choose an optimal tax on industry's transfers, for simplicity I assume here that Congress either allows or prohibits transfers.[24] Congress makes public a budget offer to the regulator, which makes actual budgets contingent on the realized price. Second, if industry transfers are allowed, then, observing Congress's offer, industry chooses its best transfer offer, which also relates industry transfers to the realized price. Third, based on those offers, the regulator decides on an unobservable action, x. Following the regulator's action, a price is observed. Budgets and transfers follow.

Congress's optimal strategies (including its decision to prohibit industry transfers) anticipate the optimal industry offer to the regulator, as well as the optimal choice of x by the regulator. Similarly, industry's optimal transfer is calculated taking into account the optimal response by the regulator. Congress and industry can then be seen as two principals trying to influence a single agent (the regulator).[25] In this article, principals' strategies are constrained. In particular, budgets and transfers cannot be negative. Also, the equilibrium concept used here requires the principals to choose optimal sequential strategies, with Congress moving first.

Congress's strategies must satisfy the regulator's individual rationality constraint. That is, the regulator's expected utility must at least exceed

[24] Different regulatory agencies impose different restrictions on senior executives' postagency employment. For example, the Federal Reserve Board allows board members to take industry jobs as long as they complete their full seven-year term. Other commissions, however, have less stringent requirements. Below, I discuss the rationale for congressional choice of different postagency employment restrictions.

[25] This model, then, captures parts of the multiple-principals/single-agent framework in B. Bernhaim & M. D. Whinston, Common Agency, 54 Econometrica 923 (1986); and the hierarchy framework developed in Jean Tirole, Hierarchies and Bureaucracies: On the Role of Collusion in Organizations, 2 J. L., Econ. & Org. 181 (1986). The hierarchy framework in this model is also related to that in Joel Demski & David E. Sappington, Hierarchical Regulatory Control, 18 Rand J. Econ. 369 (1987). While the focus of Demski and Sappington is on the role of private information by the regulatory agency, no consideration is given to the potential for third-party influence in the relation between the principal and its agent. In that sense, the framework in Demski and Sappington is in the traditional agency approach to regulation (see Baron & Myerson, *supra* note 8). See also David P. Baron, Noncooperative Regulation of a Nonlocalized Externality, 16 Rand J. Econ. 553 (1985); and John Ferejohn, Incumbent Performance and Electoral Control, 50 Pub. Choice 5 (1986), for analyses involving multiple principals.

his (known) reservation level (w^*). Industry's choice, in contrast, only takes into account the optimal choice of x by the regulator as a function of both Congress's and industry's offers.[26] Since industry benefits from no participation by the regulator, Congress must make sure that its offer provides the regulator enough utility to make his participation worthwhile for all feasible industry offers.[27] The game just described is formally presented in Appendix A.

The following notation and assumptions are used throughout the article: $U_j, j = 1, h$, represents Congress's utility from p_j; $\pi_j, j = 1, h$, is the industry profit derived from a price p_j; and $W(B, x) + T$ represents the utility of the regulator receiving a budget of B, a transfer of T, and performing the action x:[28]

$$W_B > 0, \quad W_x < 0, \quad W_{BB} < 0, \quad W_{BX} = 0, \quad W_{xx} < 0, \tag{1}$$

$$\phi'(x) > 0, \quad \phi''(x) \leq 0, \quad \phi(0) = 0, \tag{2}$$

$$\Delta U = U_1 - U_h > \pi_h - \pi_1 = \Delta\Pi > 0. \tag{3}$$

Finally, when performing comparative statics with this model, the following assumptions will be made for computational simplicity:

$$\phi''(x) = 0, \tag{4}$$

$$W_{xxx} = 0. \tag{5}$$

III. Regulatory Policy under Full Information

The thrust of this article is that informational problems are at the core of the relation between Congress and its regulators. To see the role of informational problems, it is worthwhile to analyze first the full informa-

[26] The equilibrium must also provide the principals with utility and profit levels above their nonparticipation levels. These constraints are assumed to be satisfied at the equilibrium.

[27] Alternatively, by withdrawing its transfer offer, industry could force the regulator to choose not to participate (that is, the regulator's individual rationality constraint will not be satisfied). Since in the absence of regulation a high price develops, industry would benefit from the no participation by the regulator.

[28] These assumptions are chosen so that the first-order approach to the principal-agent problem used here is valid. See William P. Rogerson, The First-Order Approach to Principal-Agent Problems, 53 Econometrica 1357 (1985); and Sandford J. Grossman & Oliver D. Hart, An Analysis of the Principal-Agency Problem, 51 Econometrica 7 (1983), for a discussion of the first-order approach and the sufficient conditions that make it valid.

tion solution to a game such as the one just described. In a full-information world, transfers from industry could be costlessly eliminated. Furthermore, industry will have no incentive to make transfers to the regulator. Instad, it will make direct transfers to Congress. Thus, industry transfers to regulators will play an important role only in an agency setting between Congress and the regulators. Since regulators' actions are observable, the only constraint Congress faces is that the contract offered to the regulator has to provide him with at least its reservation utility level. Observe, however, that, since the regulator is assumed to have disutility from effort, the equilibrium regulatory outcome implies a level of effort that may fall short of the one most preferred by Congress. In other words, simply delegating regulatory powers to an agency whose interests are not perfectly aligned with those of Congress may imply a regulatory outcome that takes other interests into account. That is, the equilibrium effort level is such that $\phi(x) \leq 1$.

The observability of the agent's actions imply that the risk-averse agent is provided with a constant payment (budget) while the single, risk-neutral principal (Congress) is allocated all the risk. Furthermore, because of the observability of the regulator's actions, he is driven to his reservation level, and Congress's welfare is maximized subject to those constraints. Consequently, the rates of substitution between effort and budget for both Congress and the regulator are equalized.[29] These results are formally presented in lemma B1 in Appendix B and are used in the next sections to compare the level of effort under full information with those achieved when the regulator's actions are not observable under the different institutional settings.

IV. Equilibrium Outcomes

This section is organized in four parts. In the first part, I discuss the regulatory equilibrium that occurs when Congress effectively prohibits industry from making any type of transfer to the regulator. This equilibrium is then compared, in the two subsequent parts, to the situation that develops when industry transfers are allowed. Since in the latter game regulators obtain rents, I introduce, in the last part of this section, competition among the regulators for regulatory positions.

[29] This result suggests that Congress could benefit from appointing regulators with "better aligned" political and regulatory tastes (see Calvert *et al.*, *supra* note 6). Once industry's transfers are introduced, however, different regulator's preferences would imply different industry transfer levels.

A. *No Industry Transfers*

If Congress is able to restrict industry from offering transfers to regulators, the game[30] becomes one between Congress and the regulator.[31] It is, then, a simple principal-agent problem. The equilibrium is then a pair (B, x), $B = (B_l, B_h)$, such that

$$x = \underset{\{x\}}{\text{argmax}} \{\phi(x)W(B_l, x) + [1 - \phi(x)]W(B_h, x)\}, \tag{6}$$

$$B = \underset{\{B_l, B_h\}}{\text{argmax}} \{\phi(x)[U_l - B_l] + [1 - \phi(x)](U_h - B_h)\}, \tag{7}$$

subject to

$$x = \underset{\{y\}}{\text{argmax}} \{\phi(y)W(B_l, y) + [1 - \phi(y)]W(B_h, y)\}, \tag{8}$$

and

$$\phi(x)W(B_l, x) + [1 - \phi(x)]W(B_h, x) \geq w^*, \tag{9}$$

where (8) and (9) represent the constraints involving the regulator's optimal choice of effort and his participation decision (or individual rationality constraint), respectively, while (6) and (7) are the regulator's and Congress's problems, respectively.

In the usual way, the model is solved backward by first analyzing the regulator's problem given in (6). The first-order condition for the regulator, for any (B_l, B_h), is given by

$$\phi'(x)[W(B_l, x) - W(B_h, x)] + W_x(B_h, x) + \xi^{Rx} = 0, \quad x\xi^{Rx} = 0.^{32} \tag{10}$$

Equation (10) establishes a correspondence between x and the actual values of Congress's budgets. The internal solution to (10) is of the form

$$x = x(B_l, B_h), \tag{11}$$

with $x_{Bl} > 0$ and $x_{Bh} < 0$.[33]

The solution to the game with no industry transfers is fully character-

[30] In what follows, I will refer to the "unrestricted' ("restricted") game as that where industry is (is not) allowed to make transfers to the regulator.

[31] This would be the case if, for example, Congress could impose a lifetime ban on private employment following governmental work and strictly control postagency earnings.

[32] The variable ξ *u2j* are slack variables associated with first-order conditions with respect to the variable j. Thus, in eq. (10), ξ^{Rx} represents the slack variable associated with the regulator's first-order condition.

[33] Assumptions (1)–(3) guarantee the signs of the partial derivatives of $x(\cdot)$, with $x_{Bl} = -\phi' W_B^l/[\phi''(W_l - W_h) + W_{xx}]$, $x_{Bh} = \phi' W_B^h/[\phi''(W_l - W_h) + W_{xx}]$, $W_j = W(B_j, x)$; W_B^j represents the derivative of $W(B, x)$ with respect to B evaluated at B_j.

ized in lemma C1 in Appendix C. A couple of results are worth noting here. First, from (10) we observe that for positive regulatory effort to be undertaken, budgets in low-price states must exceed those in high-price states. Second, Congress may find it optimal to provide zero budgets in high-price states. It is straightforward to see that, if in the equilibrium the regulator's individual rationality constraint is not binding, it does not pay Congress to provide a compensation to the regulator in high-price states. These results are at the core of the agency problem between Congress and its regulator. Compare them with the optimal budget levels under full information. In that case, Congress allocates a constant regulatory budget simply to provide the regulator with a level of utility equal to his reservation level. In the presence of informational problems, however, it becomes optimal for Congress to make budgets contingent on observable regulatory outcomes.

Finally, informational problems not only imply a different budget policy but also have an effect on the level of regulatory effort and on the level of expected regulatory budgets. Proposition D1, given in Appendix D, shows that under some conditions the full information level of regulatory effort is achievable. However, if Congress wants to achieve that level, it will have to provide, on average, larger budgets than under full information. Hence, the full information regulatory equilibrium is not an equilibrium to the restricted game. Consider now the case when Congress either chooses not to, or cannot, restrict industry transfer.

B. Equilibrium with Industry Transfers

When Congress is unable (or prefers not) to restrict industry's transfer to the regulator, competition between Congress and industry develops. The difference between the outcome to this game and the one where Congress prohibits industry transfers arises because $\pi_l < \pi_h$ while $U_l > U_h$. That is, the regulatory objectives of the two principals are contradictory. The opposite interests of industry and Congress imply that with positive industry transfers the regulator enjoys a utility level above his reservation level. Observe that the individual rationality constraint in (A3), in Appendix A, is calculated at the level of effort that the regulator would undertake if faced with $T = 0$, and $B = (B_h, B_l)$.[34] Otherwise, if with positive transfers the regulator was just obtaining its reservation utility level, industry would provide no transfer, and the regulator would choose not to participate. Thus, because industry prefers no regulation, we obtain the following corollary.

[34] This level of effort (x_0) is the equilibrium level only when the optimal industry transfer is in fact $T = 0$.

COROLLARY 1. If the equilibrium involves positive transfers by industry, then the regulator's expected utility exceeds his reservation level.[35]

Since so far no entry barriers to regulatory positions have been introduced, the existence of regulatory rents implies that potential regulators would dissipate their rents. In the next subsection I analyze in more detail the incentives for Congress to create a rent-dissipation mechanism. Here, however, the analysis continues assuming that regulatory positions have already been assigned.[36]

Let us first analyze the regulator's problem in the unrestricted game, given in equation (A1) in Appendix A. The first-order condition for the regulator, for any (B, T), is given now by

$$\phi'(x)[W(B_l, x) + T_l - W(B_h, x) - T_h] + W_x(B_h, x) + \xi^x = 0, \quad x\xi^x = 0. \tag{12}$$

COROLLARY 2. Observe that, as in the game with no industry transfers, internal equilibria imply that the regulator must prefer a low-price to a high-price outcome. That is, $x > 0$, if and only if

$$W(B_l, x) + T_l > W(B_h, x) + T_h.$$

Since it is shown below that $T_l = 0$, corollary 2 implies, again, that budgets in low-price states must exceed budgets in high-price states. Here, however, the introduction of industry transfers provides further implications, which are described in lemma 1.

LEMMA 1. The interior solution to the game with industry transfers is given by

$$T_l = 0, \quad T_h \geq 0, \tag{i}$$

$$B_l > B_h \geq 0, \tag{ii}$$

$$\text{if } \delta = 0, \quad \text{then } B_h = 0, \tag{iii}$$

$$\phi = 0 \text{ implies } B_l = 0, \quad 1 - \phi = 0 \text{ implies } T_h = 0, \tag{iv}$$

and

$$EW = \phi(x)(W_l - W_h - T_h) + [1 - \phi(x)](W_h + T_h) \geq w^*, \tag{v}$$

[35] This result does not imply that the individual rationality constraint in Congress's problem is never binding at the equilibrium since this constraint is calculated at zero industry transfers.

[36] As will become evident in the next subsection, regulatory rent dissipation has no implication for the actual level of budgets, transfers, or regulatory effort. Thus, the current omission of the mechanism to determine regulatory positions is, so far, innocuous.

with the inequality in equation (v) being strict when $T_h > 0$. The parameter δ, $0 \leq \delta \leq 1/W_B'$, represents the Lagrange multiplier associated with the individual rationality constraint in Congress's problem.

The proof of lemma 1 is given in Appendix E. The intuition behind lemma 1 is that both industry and Congress will try to influence the regulator to take favorable actions. In the case of industry, such an action would be to undertake a low regulatory effort. This can be achieved by making the compensation to the regulator very large when there is a favorable outcome (a high price), while punishing him for unfavorable outcomes. Thus, both Congress and industry make low transfers in (the respective) unfavorable outcomes (items [i]–[ii]). Since transfers are restricted to nonnegative values, the worst punishment is a transfer of zero (items [i]–[iii]). Since industry does not have to guarantee the participation of the regulator, it will always make zero transfers in unfavorable states. Congress, however, may find it necessary to provide positive budgets in high-price states so that the individual rationality constraint of the regulator is satisfied, that is, so that the expected utility of the regulator exceeds its reservation level (item [v]).

Lemma C1 (in App. C) and lemma 1 show that budget restrictions follow unfavorable outcomes and, in the unrestricted game, are accompanied by industry transfers. Thus, corollary 3 follows.

COROLLARY 3. Budget restrictions follow unfavorable outcomes for Congress and are accompanied by industry transfers.

This result arises exclusively because of the agency problems between Congress, industry, and the regulators. As discussed above, if Congress could costlessly control its regulators, budgets would be insensitive to regulatory outcomes and industry would make no transfers to regulators. Instead, industry influence could be achieved directly through transfers to congressmen. Thus, corollary 3 provides an empirically testable implication that is at the core of the agency part of the self-interest theory of regulation.

Lemma C1 and lemma 1 also show that the budget and effort allocations in the restricted and the unrestricted games are not the same.[37] In the game with no industry transfers, it can be seen as well that, for every budget offer, the optimal regulatory effort (x) exceeds that when transfers are allowed. The intuition is clear: when transfers are allowed, industry is able to compensate the regulator for high-price outcomes. Thus, given

[37] Substituting (B^*, x^*) (the solution to the equilibrium with industry transfers) into (10), we observe that the value for the left-hand side of (10) is positive. Thus, (B^*, x^*) is not a solution to the game without industry transfers.

any offer B, the regulator will tend to provide less regulatory effort.[38] Furthermore, proposition 1 shows that competition between Congress and industry generates social overexpenditure on regulation-related activities:

PROPOSITION 1. In the presence of direct industry transfers, the total monetary expenditure on regulation exceeds the minimum required to achieve the equilibrium regulatory outcome.

The proof of proposition 1 is given in Appendix F.[39] Proposition 1 impiles that, if industry were allowed to make direct transfers to Congress *but not* to the regulators, then both industry and Congress could be made better off. Thus, corollary 4 follows.

COROLLARY 4. If industry is not allowed to pay congressmen directly, social overexpenditure in regulation is an equilibrium outcome.

Observe that corollary 4 does not say that regulatory agency budgets are necessarily larger than would be if no industry transfers were allowed. Rather, total social expenditure on regulation is above what would be necessary if Congress and industry would coordinate their actions.[40] Whether actual budgets increase when industry transfers are allowed cannot be answered in general terms.[41]

C. *Comparative Statics in the Presence of Industry Transfers*

While there are feasible corner solutions when industry transfers are allowed (that is, $T = B = x = 0$, or $B \geq 0$, $x > 0$, $T = 0$), here I concentrate on internal solutions. The parameters of the model are w^*, π_1, π_h, U_1, and U_h,while the endogenous variables are B_1, B_h, T_1, T_h, and x. When the individual rationality constraint is not binding, namely $\delta = 0$, the interior solutions are functions of the profit difference, $\Delta\Pi = \pi_h - \pi_1$, and of the consumer surplus difference, $\Delta U = U_1 - U_h$. By fully differentiating the first-order conditions (see App. E, eqq. [E1a–E2b]) and holding constant $\{p_1, p_h\}$, the following comparative statics are derived.

LEMMA 2. If, in the game with industry transfers, the individual rationality constraint is not binding ($\delta = 0$), then

[38] The expected budget, however, may be higher in the unrestricted game.

[39] See Bernhaim & Whinston, *supra* note 25, for a general proof of this proposition. In Appendix F, I present a direct proof of the proposition.

[40] See Niskanen, *supra* note 4, for a different overexpenditure result.

[41] The presumption is that, since allowing industry transfers exacerbates the "agency" problem, Congress will try to control the regulator by offering him a riskier lottery (that is, Congress may want to increase the difference between B_1 and B_h). This result, while plausible, is not always correct. In Section VI, I present an example in which, when the regulator's individual rationality constraint is not binding, the equilibrium budget for the restricted and unrestricted case is the same.

$$\frac{dB_1}{d\Delta\Pi} = \frac{1}{\Omega} > 0, \qquad \frac{dB_1}{d\Delta U} = \frac{W_B^1}{\Omega} > 0,$$

$$\frac{dT_h}{d\Delta\Pi} = 1/2 + \frac{W_B^1}{2\Omega} > 0, \qquad \frac{dT_h}{d\Delta U} = \frac{(W_B^1)^2}{2\Omega} > 0,$$

$$\frac{dx}{d\Delta\Pi} = \frac{\phi'(x)[W_B^1 - (\Delta U - B_1)W_{BB}^1]}{2W_{xx}\Omega} < 0,$$

$$\frac{dx}{d\Delta U} = \frac{-\phi'(x)(W_B^1)^2}{2W_{xx}\Omega} > 0,$$

where $\Omega = 2W_B^1 - (\Delta U - B_1)W_{BB}^1 > 0$. The proof of lemma 2 is straightforward and is not presented here. It involves taking the full derivatives of the first-order conditions of the unrestricted game.[42]

Lemma 2 has several empirical implications that are similar to those originally developed in Peltzman.[43] Here, however, these results do not arise from the workings of Peltzman's "political wealth effect" but, rather, from competition between the two principals in an "agency" framework.[44] First, observe that, if the marginal utility of a dollar of budget (in the low-price state) is less than the marginal utility of a dollar of transfer ($W_B^1 < 1$), then budgets, transfers, and regulatory effort are more sensitive to changes in profit differentials ($\Delta\Pi$) than to changes in consumer-surplus differentials (ΔU). The rationale for this result is that, if in equilibrium $W_B^1 < 1$, then Congress compensates regulators with a relatively inefficient instrument, and a marginal increase in budgets increases regulatory effort by less than a marginal increase in transfers ($|dx/dB_1| = -\phi'(x)W_B^1/W_{xx} < -\phi'(x)/W_{xx} = |dx/dT_h|$). That would not be the case if Congress could make direct monetary transfers to its regulators. Thus, we can state proposition 2.

PROPOSITION 2. If, in the solution to the game with industry transfers, $W_B^1 < 1$, and if the regulator's individual rationality constraint is not binding ($\delta = 0$), then changes in budgets, transfers, and regulatory effort

[42] When $\delta > 0$, the comparative statics become much more complicated. Still, it can be shown that the following holds:

$$\frac{dB_1}{d\Delta U} > 0, \quad \frac{dB_h}{d\Delta U} < 0, \quad \frac{dT_h}{d\Delta U} > 0, \quad \frac{dx}{d\Delta U} > 0,$$

$$\frac{dB_1}{d\Delta\Pi} > 0, \quad \frac{dB_h}{d\Delta\Pi} < 0, \quad \frac{dT_h}{d\Delta\Pi} > 0, \quad \frac{dx}{d\Delta\Pi} < 0.$$

[43] Peltzman, *supra* note 1.

[44] That this model shares, under some conditions, many of Peltzman's results (see *id.*, *supra* note 1) is not surprising once it is realized that the regulator in the current model takes both Congress's (or consumers') and industry's interests into account.

are more sensitive to changes in profit differentials than to changes in consumer surplus differentials.

Proposition 2 also implies that the regulatory system will be less responsive to political changes (in Congress's ΔU) than to changes in technology (whch change $\Delta\Pi$ but not necessarily ΔU).

Most of Peltzman's main results can be derived from this framework by the introduction of some additional assumptions. For example, if the distribution of the potential outcomes of the regulatory activity (that is, $\{p_1, p_h\}$) remains constant, then an increase in marginal cost would increase the profit differential ($\Delta\Pi$) but not consumer surplus differential (ΔU). Consequently, an increase in marginal cost implies a reduction in regulatory effort, increasing the expected price. In contrast, an increase in demand increases both the profit and the consumer differential, which have opposite effects on the regulator's incentive to provide effort. Thus, increases in demand will increase both budgets and transfers, with a small effect on the equilibrium price distribution. A similar increase in the profit differential arising from a marginal cost increase will have a larger effect on expected prices.

Thus, from proposition 2 we obtain corollary 5.

COROLLARY 5. The regulatory system dampens the effect of demand but magnifies the effect of costs on expected prices.

Furthermore, if during booms ΔU increases but $\Delta\Pi$ falls, with the opposite holding during recessions,[45] then lemma 2 predicts that regulatory effort will increase during booms and fall during recessions. The rationale for this result is that during booms Congress's willingness to pay for regulatory effort increases while industry's falls. Thus, corollary 6 follows.

COROLLARY 6. If ΔU ($\Delta\Pi$) is procyclical (anticyclical), then regulations are oriented toward "consumer protection" during booms and toward "producer protection" during recessions.

From lemma 2 we also obtain that the regulation of industries with low costs will be more weighted toward "consumer protection" than that of high-cost industries. If regulated industries differ only in their productivity (more precisely, in their marginal cost), then the more productive industries will have lower $\Delta\Pi$s and will subject to higher levels of regulatory effort. Thus, while more productive industries may have higher profits, they may also be more heavily regulated. As in Peltzman,[46] profits and "industry capture" will be negatively correlated. Another similar

[45] This will be the case if during booms productivity increases while demand functions rotate outward and become more elastic.

[46] Peltzman, *supra* note 1.

implication[47] relates to Congress's incentives to regulate industries. In particular, since so far we have assumed that Congress cannot extract the rents from its regulators, its largest regulatory benefits arise from large-demand, low-cost industries. In those industries the profit differential is smaller, implying smaller regulatory agency costs. Thus, we can state lemma 3.

LEMMA 3. If Congress cannot extract the regulator's rents, and if in the equilibrium the individual rationality constraint is not binding ($\delta = 0$), then Congress's benefits from regulation are increasing in consumer surplus but decreasing on the profit differential.[48]

This result, however, may not follow if Congress is able to extract regulator's rents. In particular, see lemma 4.

LEMMA 4. If the individual rationality constraint is not binding, then regulators' rents increase with both ΔU and $\Delta\Pi$.[49]

The proofs of lemmas 3 and 4 are straightforward and are not presented here.

Lemmas 3 and 4 introduce the possibility that by extracting regulators' rents, Congress's benefits from regulation may actually increase with the extent of industry opposition to regulation (that is, with the industry's profit differential). In this case, Congress's incentives to restrict industry transfers may fall. These issues are analyzed next.[50]

[47] *Id.*

[48] It is straightforward to see that

$$\frac{dEU}{d\Delta\Pi} = \frac{[\phi'(x)]^2[W_B^1 - (\Delta U - B_1)W_{BB}^1]}{2W_{xx}[2W_B^1 - (\Delta U - B_1)W_{BB}^1]} - \frac{\phi(x)}{[2W_B^1 - (\Delta U - B_1)W_{BB}^1]} < 0, \quad \frac{dEU}{d\Delta U} = \phi(x),$$

where $EU = \phi(x)(U_1 - B_1) + [1 - \phi(x)](U_h - B_h)$.

[49] That is, if in the solution to the game with industry transfers the individual rationality constraint is not binding, then

$$\frac{dEW}{d\Delta\Pi} = [1 - \phi(x)]/2 + [1 + \phi(x)]\frac{W_B^1}{[2W_B^1 - (\Delta U - B_1)W_{BB}^1]} > 0,$$

and

$$\frac{dEW}{d\Delta U} = \frac{(W_B^1)^2}{2[2W_B^1 - (\Delta U - B_1)W_{BB}^1]}[1 + \phi(x)] > 0,$$

where $EW = \phi(x)[W(B_1, x) - W(B_h, x) + T_1 - T_h] + W(B_h, x) + T_h - T_1$.

[50] Observe that the cases where Congress chooses to regulate industries with large $\Delta\Pi$ resemble extortion by regulation. That is, the equilibrium outcome implies low regulatory activity but large industry transfers, which Congress eventually appropriates. Thus, even if ΔU were very small, Congress may find it worth regulating, simply to extract rents. These issues are further discussed below.

D. *Bidding for Regulatory Positions*

As discussed above, if industry transfers are positive, regulators receive rents.[51] A bidding process, then, should develop by which potential regulators transfer all their expected rents to Congress. The actual bid, however, has no effect on the regulator's incentives once on the job. Thus, the bidding process by itself has no effect on the equilibrium budgets, transfers, or regulatory effort or on the regulator's individual rationality constraint.[52] I combine lemmas 3 and 4 to obtain corollary 7.

COROLLARY 7. If potential regulators bid all their expected excess rents to Congress, and if in the equilibrium the regulator's individual rationality constraint is not binding ($\delta = 0$), then it is feasible that increases in the profit differential increase Congress's expected utility from the regulation.[53]

Corollary 7, then, implies that Congress may find it optimal not to restrict industry transfers. The following section analyzes conditions under which Congress may allow industry to make transfers to regulators.

V. OPTIMAL CHOICE OF RESTRICTIONS ON INDUSTRY TRANSFERS

The ability of industry to make transfers to regulators has two counterbalancing effects on congressional benefits from regulation. On the one hand, industry transfers exacerbate the "agency" problem between Congress and the regulator. On the other hand, regulator's rents are larger when industry transfers are allowed. Congress will then balance increased appropriation of regulator's rents against a lower level of direct regulatory

[51] This result holds even when the individual rationality constraint is binding.

[52] Would-be regulators are supposed to bid for their rights to become regulators. If regulatory appointments were allocated to the highest bidder, then the regulator that can capture the largest rent would obtain the position. Thus, the would-be regulator with the lowest w^* will obtain the position. If regulator's utility were also a function of the regulatory outcome, then regulatory rents would also depend on the characteristics of the regulator's utility function. Congress would then allocate regulatory positions on that basis. On a model trying to explore this insight, see Matthew D. McCubbins, Roger G. Noll, & Barry R. Weingast, Administrative Procedures as Instruments of Political Control (presented at the symposium on the Law and Economics of Procedure, Columbia Law School, New York, February 1987). Observe also that for regulators to be able to bid their expected rents, they must have either acess to credit markets or assets of equivalent value.

[53] Formally, under the conditions of corollary 7,

$$\frac{dEU^B}{d\Delta\Pi} = \frac{W_B^1[1 + \phi(x)] - 2\phi}{2[2W_B^1 - (\Delta U - B_1)W_{BB}^1]} + \frac{(1 - \phi)}{2} + \frac{(\phi')^2[W_B^1 - (\Delta U - B1)W_{BB}^1]}{2W_{xx}[2W_B^1 - (\Delta U - B_1)W_{BB}^1]}$$

$$\gtrless 0, \frac{dEU^B}{d\Delta U} = \phi + (1 + \phi)\frac{(W_B^1)^2}{2[2W_B^1 - (\Delta U - B_1)W_{BB}^1]} > 0,$$

where $EU^B = EU + EW - w^*$.

benefit. Thus, if the direct cost of lower regulatory effort is too large (namely, a large ΔU) then Congress should prefer to restrict industry transfers.

If the individual rationality constraint is binding in the restricted game, however, then in the absence of industry transfers there are no rents that Congress can appropriate from the regulators. Thus, the gains from allowing industry transfers may substantially exceed those that can be obtained when the individual rationality constraint is not binding in the restricted game. Therefore, we should expect less restrictions on industry transfers for regulators whose reservation utility levels are relatively high.

Proposition 3 shows that, if Congress cannot capture the regulators' rents, then in the absence of enforcement costs Congress will choose to prohibit industry from making transfer offers.

PROPOSITION 3. Under assumptions (1)–(5), in the absence of regulatory bidding, $EU^R > EU^U$, where EU^R (EU^U) represents Congress's expected utility when industry transfers are prohibited (allowed).

The proof of the proposition is given in Appendix G. The intuition for this proposition is clear. Industry transfers increase the cost of regulations, reducing Congress's expected gains from regulation. This proposition has implications for understanding the process of regulatory appointments and interest group influence. If Congress could not extract rents from the regulators, it would prefer to deter interest groups from directly influencing the regulatory process. Restricting interest groups, however, may be costly. In that case, partial restrictions may be optimal. They may be implemented in two different ways. First, all regulators may be deterred equally from employment in agency-related businesses. Alternatively, different regulatory agencies may stipulate different restrictions. The current model provides a direct rationale for Congress to impose different postagency employment restrictions across agencies. If the cost of enforcing those restrictions are independent of their benefits,[54] then agencies where the difference between EU^R and EU^U is not too large should have more permissive postagency employment restrictions. In the example given in Section VI, the larger ΔU, the larger the difference between EU^R and EU^U.[55] Also, for the same example, Table 1 shows that the larger w^*, the lower the difference between EU^R and EU^U. Observe, also, that regulatory effort increases with ΔU but falls with w^*. Thus, the industries for which it is optimal to relax postagency employment restric-

[54] Enforcement costs relate to those costs incurred in order to deter industry from making payments to regulators. These costs may involve the costs of examining former regulators' income tax returns, enforcing restrictions on postagency employment, and so on.

[55] This can be seen from Table 1 for the case of $w^* > \Delta U/12$ and from comparing lemmas 5 and 6, below, for the case when $w^* < \Delta U/12$.

TABLE 1

SIMULATION RESULTS

ΔU (1)	w^* (2)	EU^{BU} (3)	EU^U (4)	EB^U (5)	EU^R (6)	EB^R (7)
2.2	.2	.610	.313	.179	.626	.358
	.4	.524	.204	.383	.429	.625
	.6	.324	.004	.583	.149	.762
	.8	.044	−.276	.863	−.191	.999
	1.0	−.316	−.636	1.223	−.600	1.327
2.6	.4	.648	.318	.464	.638	.852
	.6	.448	.118	.664	.328	.924
	.8	.168	−.162	.944	−.033	1.136
	1.0	−.192	−.522	1.304	−.458	1.448
3.0	.4	.775	.443	.506	.885	1.012
	.6	.578	.245	.765	.536	1.144
	.8	.298	−.035	1.045	.148	1.304
	1.0	−.062	−.395	1.405	−.295	1.591
3.6	.4	.965	.632	.506	1.265	1.012
	.6	.789	.465	.929	.916	1.516
	.8	.505	.186	1.262	.469	1.655
	1.0	.145	−.174	1.623	−.012	1.864
	1.2	−.295	−.614	2.062	−.547	2.212
4.0	.4	1.092	.759	.506	1.518	1.012
	.6	.944	.620	.929	1.239	1.859
	.8	.652	.358	1.431	.724	2.069
	1.0	.250	.000	1.999	.206	2.103
	1.2	−.190	−.440	2.439	−.352	2.404

NOTE.—We denote

$$EU^{BU} = \phi(U_l - B_l) + (1 - \phi)(U_h - B_h) + EW - w^*,$$

and

$$EU^U, EU^R = \phi(U_l - B_l) + (1 - \phi)(U_h - B_h),$$

where values are given by lemmas 5 and 6 for the restricted and the unrestricted case, respectively.

tions are also those where regulatory effort (in the absence of industry transfers) would not have been "too" large. Allowing transfers would further reduce the extent of regulatory effort. Thus, on average, the regulatory process should be more proindustry in cases for which Congress allows direct industry influence.

VI. REGULATORY BIDDING AND OPTIMAL RESTRICTIONS: AN EXAMPLE

The purpose of this example is to present, for a specific probability and regulatory utility functions, conditions under which Congress will allow industry transfers when regulators' jobs are obtained through bidding.

The regulator's utility and probability functions are specified as follows:

$$W(B, x) = \sqrt{B} - x^2, \tag{13}$$

$$\phi(x) = x, \quad 0 \leq x \leq 1. \tag{14}$$

Also, I normalize the problem by assuming

$$\Delta\Pi = \pi_h - \pi_l = 2. \tag{15}$$

Below I analyze the solution to the games when Congress does and does not allow industry transfers. First, lemmas 5 and 6 present the equilibria under both regimes. Substituting assumptions into the first order conditions for the restricted and unrestricted games, we obtain the following results.[56]

LEMMA 5. Under assumptions (1)–(5) and (13)–(15), in the absence of direct industry transfers, the equilibrium is characterized by

$$x = (\sqrt{B_l} - \sqrt{B_h})/2, \quad \delta > (=) \quad 0 \quad \text{if } w^* > (<) \ \Delta U/12,$$

and, if $\delta = 0$, then

$$B_l = \Delta U/3, \quad B_h = 0,$$

$$EU^R = (\Delta U/3)\sqrt{(\Delta U/3)} + U_h,$$

$$EW^R = \Delta U/12,^{57}$$

where $EU^R = \phi(U_l - B_l) + (1 - \phi)(U_h - B_h)$, and $EW^R = \phi W(B_l, x) + (1 - \phi)W(B_h, x)$.

LEMMA 6. Under assumptions (1)–(5) and (13)–(15), in the presence of direct industry transfers, the equilibrium is characterized by

$$x = (\sqrt{B_l} - \sqrt{B_h} - T_h)/2,$$

$$T_h = (\sqrt{B_l} - \sqrt{B_h})/2,$$

$$T_l = 0, \ \delta^c > (<) \ 0 \quad \text{if } w^* > (<) \ \Delta U/12,$$

and, if $\delta^c = 0$, then

$$B_l = \Delta U/3, \quad B_h = 0,$$

$$EW^U = \Delta U/48 + \sqrt{(\Delta U/12)} > \Delta U/12 > w^*,$$

and

$$EU^U = (\Delta U/6)\sqrt{(\Delta U/3)} + U_h),^{58}$$

[56] See Appendix E for the first-order conditions of the game with industry transfers. The first-order conditions for the game without industry transfers can be similarly derived.

[57] If $\delta > 0$, then B_h and B_l are implicitly determined by $\Delta U - 12(w^* - \sqrt{B_h}) + 8(w^* - \sqrt{B_h})\sqrt{(w^* - \sqrt{B_h})} - 4\sqrt{B_h}\sqrt{w^* - \sqrt{B_h}}) = 0$, and $\sqrt{B_l} = \sqrt{B_h} + 2\sqrt{(w^* - \sqrt{B_h})}$.

[58] If $\delta^c > 0$, then $\sqrt{B_h}$ and $\sqrt{B_l}$ are implicitly given by $\sqrt{B_l} = \sqrt{B_h} + 2\sqrt{(w^* - \sqrt{B_h})}$, and $\Delta U - 12(w^* - \sqrt{B_h}) + 8(w^* - \sqrt{B_h})\sqrt{(w^* - \sqrt{B_h})} = 0$.

where EU^U (EW^U) represents Congress's (the regulator's) expected utility in the unrestricted case.

The proofs of lemmas 5 and 6 are derived from lemmas C1 and 1 and are not presented.[59]

I will now analyze congressional choice of restrictions, assuming that restrictions are chosen to capture regulators' rents. A bidding process, by which regulators bid up to their expected rents ($EW - w^*$), constitutes such a process.[60] The following proposition presents the result of the institutional comparison in the presence of regulatory bidding.

PROPOSITION 4. Under assumptions (1)–(5) and (13)–(15), if regulators' jobs are obtained through bidding, then, if the individual rationality constraint is not binding (that is, $\delta = 0$ for $w^* < \Delta U/12$), then, for $\Delta U < 2.0663$, $EU^{BU} > EU^R$.

Variable EU^{BU} (EU^R) represents Congress's expected utility when transfers are (are not) allowed and regulators bid (do not bid) for their positions. When the individual rationality constraint is not binding, direct comparison of EU^{BU} and EU^R from lemmas 5 and 6 can be performed, showing the proposition.

The result presented in proposition 4 can be augmented by analyzing the simulation results presented in Table 1, columns 3 and 6. There it is seen that, when the individual rationality constraint is binding (that is, $w^* > \Delta U/12$), then, for each ΔU, there exists a $W^*(\Delta U)$ such that, for $w^* > W^*(\Delta U)$, $EU^{BU} > EU^R$.[61]

These results provide the strongest self-interest argument for Congress to allow direct industry transfers to regulators. By increasing regulator's rents, direct industry transfers increase the amount potential regulators are willing to bid for their positions, increasing congressmen's rents from the political process. Observe that allowing industry transfers may actually benefit the industry and hurt consumers. If consumers do not appropriate congressmen's rents, then proposition 3 implies that allowing trans-

[59] it is straightforward to see that the following comparative statics hold:

$$dT_h/dw^* \geq 0, \quad dB_1/dw \geq 0, \quad dB_h/dw^* \leq 0, \quad dEB/dw^* \geq, \quad dx/dw^* \geq 0,$$

and

$$dT_h/d\Delta U > 0, \quad dB_1/d\Delta U > 0, \quad dB_h/d\Delta U < 0, \quad dEB/d\Delta U > 0, \quad dx/d\Delta U > 0,$$

where EB represents the expected congressional budgetary allocation.

[60] If Congress captures the regulators' rents, then Congress's ex ante expected utility will be given by $EU^B = EU + EW - w^* = \phi(x)(U_1 - B_1) + [1 - \phi(x)](U_h - B_h) + \phi(x)(W_1 + T_1) + [1 - \phi(x)](W_h - T_h) - w^*$.

[61] Observe that, if there are enforcement costs, then the inequalities in proposition 4 should be further relaxed.

fers makes them worse off.[62] Industry, however, may benefit. Observe first that the equilibrium conditions for internal solutions require that industry's best response to a congressional budget offer be a positive transfer. Thus, in equilibrium, a positive transfer provides higher profits than a zero transfer. Budget offers, however, may differ across institutional arrangements, and, thus, it is conceivable that industry could be made worse off by allowing transfers.[63] In the example provided in this section, however, industry's profits are larger when transfers are allowed.[64,65] Thus, corollary 8 follows.

COROLLARY 8. If regulators bid for their jobs, Congress would prefer to allow industry transfers if regulators' reservation utility level is relatively high or if the costs from a lower regulatory effort level (ΔU) are relatively low.

VII. A TEST OF THE MODEL

The model presented in this article can be tested by analyzing the determinants of the career path of bureaucrats. The main implications of the agency model developed above are first, Congress and industry will reward regulators for favorable outcomes by increasing their transfers; second, regulators' rents are dissipated through bidding for regulatory positions. Appointments, then, take the form of patronage. Real politics, however, are not as simple as the model presented here. In particular, politicians have other instruments to reward regulators for favorable outcomes. Regulators may be appointed to more prestigious positions in the public sector (like cabinet positions) or rewarded with access to Congressmen, thereby increasing their general productivity. Since commissioners leave their agencies almost every year, Congress will use all its instruments to reward and punish its regulators. If there is a favorable outcome, the commission's budget will be increased, and those regulators that quit the agency will be provided with other nonbudgetary compensations.

[62] This result shows that there is also an important agency problem between voters and their own representatives that in a more general framework should also be addressed.

[63] In particular, if the equilibrium regulatory effort does not differ much under both institutional regimes, allowing transfers may imply a lower industry-expected profit. Hence, industry may find it worth supporting restrictions on its own transfers.

[64] It is easy to compute that, if the individual rationality constraint is not binding, then the increase in industry's expected profits from allowing transfers to the regulators equals $\Delta U/24$.

[65] Industry and consumers, however, could be made better off by allowng transfers only to congressmen. See proposition 1.

Similarly, industry does not have to provide the regulator with a job to compensate him for favorable outcomes. For example, the regulator may go to work for a law firm, with industry channeling some of its legal work through it.

Thus, the strongest empirical implication of the model is that, conditioned on a regulator quitting the commission, the probability of going to work (directly or indirectly) for the industry falls with the agency's budget during the regulator's last period at the agency.[66,67]

Eckert[68] shows that the typical career path for regulatory commissioners consists of coming to the agency with substantial previous public-sector experience and, in an important proportion, leaving the commission to work (directly or indirectly) for the industry they previously regulated. As Eckert suggests, this stylized fact cannot reject the specific-capital hypothesis—namely, that during their tenure at the commissions regulators acquire substantial industry-specific capital, making an industry-related position more attractive. The specific-capital hypothesis, however, does not share the main empirical implication of the agency framework. In particular, if the regulator's ability is unknown to the private sector, an augmented signaling-cum-specific-capital hypothesis would predict a positive, rather than negative, correlation between budgets and the probability of regulated industry jobs. A larger budget would imply that the regulator is an able and productive manager. Since he also has acquired industry-specific capital, larger budgets should be positively correlated with industry jobs.[69]

A second empirical implication of the model is the use of patronage. Clearly, not all regulatory appointments are patronage appointments. Many (and perhaps some of the most important) regulators have had no public service experience at all. The rationale for their appointment may not be to capture their potential economic rents but, rather, to appoint regulators whose ideological preferences or interests are similar to those

[66] It is clear that the decision to quit at a given period depends on (among other things) the available offers the regulator has received. Therefore, the optimal quitting time and post-agency employment will be related. While a general model that estimates simultaneously the optimal length of stay at the agency and the optimal career choice could be developed, it is beyond the scope of this work.

[67] The type of budget concept that I use is described in Section VIII.

[68] Ross D. Eckert, The Life Cycle of Regulatory Commissioners, 24 J. Law & Econ. 113 (1981).

[69] A positive correlation between industry jobs and budgets is further strengthened from a strategic consideration. Since industry prefers to be regulated by ineffective regulators, it may find it optimal to hire those commissioners that turn out to be efficient regulators. Thus, if a larger budget is a proxy for the regulator's unobserved ability, the probability of an industry job increases with the budget.

of congressmen. Those regulators, then, will be less receptive to industry offers. Thus, the probability of obtaining industry-related jobs should be smaller for nonpatronage appointments.[70]

A third empirical implication is derived from the passing, in 1978, of a broad government ethics bill (S.555) imposing new restrictions on senior government employees' postgovernment employment. Under the new bill, former employees could never lobby the government on matters they directly worked on. The bill also required a cooling-off period of one or two years in which former government employees would be restricted from contacting their former agencies.[71] Following the passage of the ethics bill, then, industry's cost of transfers would increase. Thus, the correlation between the probability of an industry job and budgets should be weakened following the introduction of the ethics bill. Furthermore, the overall probability of an industry job should fall following the ethics bill.[72]

A test of the model consists of estimating the determinants of the conditional probability of a regulator working for the industry following his tenure at a commission. While the empirical specification used here does not provide an estimate of the structural parameters of the model, the model will not be supported by the data if the probability of going to work for industry does not fall with the agency's discretionary budget during the last period of the regulator's tenure.

The empirical model to be used is a probit model, with $\text{prob}(\text{PostInd}_i = 1) = F(\mathbf{X}_i\beta)$, $i = 1, N$, where PostInd is a dummy variable taking a value of one if the regulator's job after the commission is directly or indirectly related to the regulated industry, $F(\cdot)$ is the normal cumulative distribution function, β is the vector of parameters to estimate, and $\mathbf{X}$ is a vector of exogenous variables given by $\mathbf{X}$ = (Patronage, Age, DBudget, Ethics, DBudget*Ethics, Other Dummies). Variable Patronage takes a value of one if the regulator had public-sector experience preceding his commission appointment; Age is the age of the regulator when leaving the commission; DBudget is a measure of the discretionary budget during the

[70] In contrast, it is conceivable that public-sector experience is a way for politicians to learn potential regulators' preferences. In that case, there may not be any difference between patronage and nonpatronage appointments, except that the former is a way for congressmen to extract the regulators' rents.

[71] The bill was first introduced in 1977 and drew substantial support in both the House and the Senate. The Senate passed an omnibus government ethics bill in June 1977, but the House's proliferation of ethics bills indicated that the final passage of the bill had to be postponed until 1978.

[72] Actually, since in early 1977 it was already clear that the bill would pass (see Cong. Q. Weekly Rep. 2353 (December 3, 1977)), the effect of the ethics bill should have started being felt then.

regulator's last year at the commission; and Ethics is a dummy taking a value of one if the regulator left the commission in 1977 or later. The other dummies are described in the next section.

VIII. The Data

The data set is composed of the career path of regulators for the Interstate Commerce Commission (ICC), Civil Aeronautics Board (CAB), and Federal Communications Commission (FCC) and a measure of discretionary budgets.

A. Career Path of Regulators

Most of the data on the career path of bureaucrats used here were generously provided by Professor Ross Eckert of Claremont McKeena College.[73] For each regulator, Eckert collected the period of his or her tenure at the commission, as well as his or her pre- and postagency experience. This data set consists of all regulators that were appointed until 1978. Following a methodology similar to Eckert's, I collected information for those commissioners who were appointed after 1978 and who completed their work at the commissions by 1984. I also checked and updated the information in Eckert's data set.

For each regulator, I have information on age, tenure at the commission, and pre- and postagency experience. I created a postindustry dummy (PostInd) equal to one if the postagency employment of the regulator is directly or indirectly related to the regulated industry. A direct relationship means being an employee of a regulated firm. An indirect relationship means working for a law firm that does industry work. Similarly, I created a patronage dummy equal to one if the regulator's preagency employment was in the public sector and a preindustry dummy that equals one if the preagency employment of the regulator was directly or indirectly related to the regulated industry.[74]

[73] Unpublished data, provided by Professor Ross Eckert, Dep't of Econ., Claremont McKeena College, 1985; specific information available from author on request.

[74] There are several recent examples of congressional staff members who became commissioners. For example, during the 1970s, ICC Commissioners Stafford, Gresham, O'Neal, and Gillian and FCC Commissioners Cox, T. Brown, Burch, Quello, and Fogarty were all congressional advisors or staff members prior to becoming commissioners. Many others were members of Congress (for example, ICC Commissioner Jackson), staff members of the commission (for example, CAB Commissioners Adams, O'Melia, and Johnson), or served as advisors to the executive branch (for example, FCC Commissioners Loevinger and Washburn and CAB Commissioners Gillilland and Kahn). Party activities and affiliation were extremely difficult to find. however, CAB Commissioner Schaffer seems to have been

For a regulator to be in the sample, the main requirement was to have a complete career path. Since I did not use the information on regulators who were incumbent as of 1985 or who died in office, not all regulators in Eckert's sample are in mine. Also, I did not include in the sample regulators for whom I was not able to find a specific post- or preagency activity (whether retired or still at work). Because of the need to have a consistent time series of discretionary budgets, my data set includes only those regulators who left the ICC after 1932, the CAB after 1943, and the FCC after 1939.[75]

The data sources were multiple and similar to those described in Eckert.[76] Multiple issues of the following *Who's Who* were used: *Who's Who in America, Who's Who in American Politics, Who's Who in Finance and Industry,* and *Who's Who in Government.*[77] Newspaper sources were the *New York Times* and the *Wall Street Journal.*[78] The source on law firm affiliation and nature of legal practice was the *Martindale-Hubbell Law Directory.*[79] Eckert also provided me with press releases of the different commissions listing the backgrounds of their current commissioners.[80] The information offices of the different agencies also provided information about some of their previous commissioners' postagency employment.[81]

B. Discretionary Budgets

For each agency, I collected the annual congressional appropriation. From this figure, I was interested in capturing the portion that is "discretionary." I define "discretionary" as unexplained by business cycle conditions, trends, or general movements in the federal civilian budget. Thus,

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an active party member, as he was a delegate to the 1972 Democratic National Convention, and FCC Commissioner Ferris held several positions with the Democratic Policy Committee.

[75] The reason for selecting this sample is that the estimation of the budget equation uses lagged values of budgetary appropriations. Consequently, I include CAB and FCC regulators that left their commission not earlier than three years following the first congressional budgetary appropriation for their commission. To be able to have a comparable institutional framework for the three agencies, I included only ICC commissioners that left the ICC after 1932.

[76] See note 68 *supra.*

[77] For the years 1939–84, specific information is available from author on request.

[78] Numerous issues from 1939 to 1984 (especially the New York Times obituaries); specific information is available from the author on request.

[79] For the years 1939–84, specific information is available from the author on request.

[80] See note 73 *supra.*

[81] Telephone interviews, 1986; specific information is available from the author on request.

TABLE 2

PREAGENCY AND POSTAGENCY EMPLOYMENT OF REGULATORY COMMISSIONERS

	ICC (n = 46)	CAB (n = 35)	FCC (n = 48)	Total (n = 129)
Preagency employment:				
Regulated industry	9	1	10	20
Public sector	32	28	36	96
Other private sector	5	6	2	13
Postagency employment:				
Regulated industry	21	15	22	58
Public sector	7	7	8	22
Other private sector	18	13	18	49

SOURCE.—See text.

for each agency, I estimated a basic budget equation of the following form:

$$\begin{aligned}\text{Budget}_{ti} = {} & a_{0i} + a_{1i}\text{NonDefense}_t + a_{2i}\text{Unemployment}_t \\ & + a_{3i}\text{Budget}_{it-1} + a_{4i}\text{Budget}_{it-2} + a_{5i}\text{Budget}_{it-3} \\ & + a_{6i}\text{Trend} + a_{7i}\text{Trend}^2 + e_{it}, \quad i = \text{CAB, FCC, ICC,}\end{aligned}$$

where NonDefense represents total federal nondefense expenditures and Budget, the agency appropriation for the year. Both NonDefense and Budget are deflated by the consumer price index and are expressed in natural logarithms.

To obtain from the basic budget equation a measure of the discretionary budget during the last year of the regulator's tenure at the commission, I estimated the budget equation for that commission with the sample period, excluding the year in consideration. For a specific agency, the discretionary budget for that year was then defined as the (out-of-sample) prediction residual. To make the three time series of discretionary budgets comparable across agencies, I normalized them by dividing each constructed agency's time series by its standard deviation.[82]

IX. THE EMPIRICAL RESULTS

Table 2 presents the distribution of regulators by agency and occupation, and Table 3 presents the occupation matrix. Of the 129 regulators, three-quarters came to the agency with pubic-sector experience, and al-

[82] See Table 5 for the means and standard deviation of each agency's time series of discretionary budgets.

TABLE 3

EMPLOYMENT TRANSITION MATRIX

POSTAGENCY EMPLOYMENT	PREAGENCY EMPLOYMENT		
	Public Sector	Regulated Industry	Other Private Sector
Public sector	18	2	2
	(.19)	(.10)	(.15)
Regulated industry	47	7	4
	(.49)	(.35)	(.31)
Other private sector	31	11	7
	(.32)	(.55)	(.54)
Total	96	20	13

SOURCE.—See text.
NOTE.—Percentages are given in parentheses.

most half left to work directly or indirectly for the regulated industry. While 49 percent of patronage appointments went to work for industry following their tenure at the commission, only a third of the regulators that came from the private sector did so.[83] There were no major differences across agencies, except that, in this sample, only one CAB commissioner came from the regulated industry.

Table 4 presents the budget equations for the three agencies. All budgets were correlated with general nondefense expenditures and were sensitive to general business-cycle conditions. However, while CAB's and ICC's budgets increased with unemployment, FCC's budgets fell. There does not seem to be remaining serial correlation of the residuals.[84] Table 5 shows the distribution of the logarithm of discretionary budgets for the regulators in my sample. There is substantial variation in the logarithm of discretionary budgets, and their means are not statistically different from zero.

Table 6 presents the main empirical results. The main hypotheses being tested are whether larger discretionary budgets and the ethics bill of 1978 reduce the probability of obtaining a regulated-industry job and whether previous public employment increases the probability of obtaining a regulated-industry job. Different specifications are presented[85] trying to cap-

[83] Thus, as expected, this sample does not differ much from Eckert's, *supra* note 67.

[84] Since there are lagged-dependent variables in the right-hand side, Durbin's h test and the t-statistic for first-order serial correlation are reported.

[85] I tested whether the probit equation can be pooled across the different agencies. To perform the test, I estimated a probit equation where all parameters are allowed to vary across agencies and tested whether the restriction that all parameters are the same across

TABLE 4

BUDGET EQUATIONS, DEPENDENT VARIABLE: REAL BUDGETARY APPROPRIATION IN LOGARITHMS

	ICC	CAB	FCC
Constant	−1.41	−.33	1.17
	(−1.18)	(−.44)	(1.21)
Real nondefense expenditures	.17	.22	.41
	(2.21)	(3.18)	(3.05)
BUDGET(−1)	1.13	.88	.64
	(9.36)	(5.74)	(4.74)
BUDGET(−2)	−.35	−.03	−.14
	(−1.93)	(−.17)	(−1.06)
BUDGET(−3)	−.06	−.23	−.28
	(−.41)	(−1.51)	(−3.50)
TREND	.04	.04	.6E-3
	(2.52)	(3.03)	(.08)
TREND2	−.3E-3	−.9E-3	12E-3
	(−2.63)	(−4.13)	(.79)
Unemployment	.01	.02	−.02
	(2.42)	(1.71)	(−3.30)
R^2	.91	.98	.97
D-W	2.006	1.958	1.905
Durbin-*h*	−.045	1.167	.949
t-statistic for AR(1)	−.446	.174	.443
No. of observations	53	42	48

NOTE.—Results are from ordinary least squares estimation; D-W is the Durbin-Watson statistic.

TABLE 5

DISTRIBUTION OF DISCRETIONARY BUDGETS

	ICC	CAB	FCC
Mean	−.01961	.00146	−.00796
Standard deviation	.09769	.08656	.10118

SOURCE.—Table 4.

agencies can be rejected. The test is given by $-2(\log LU - \log LR)$, where log LR (log LU) is the logarithm of the restricted (unrestricted) estimation, and it is distributed as $\chi^2(q)$, with q being the number of restrictions. For the specification chosen, the statistic was equal to 9.322, which is smaller than the critical value for all normal confidence values. The specification on which this test was performed did not include the unemployment, female, or Republican variables.

TABLE 6

PROBIT EQUATION, DEPENDENT VARIABLE: REGULATORS' POSTCOMMISSION REGULATED INDUSTRY EMPLOYMENT (N = 129)

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.40	6.13	5.99	6.44	6.51	4.67
	(2.17)	(2.41)	(2.37)	(2.55)	(2.61)	(2.00)
Patronage	.49	.58	.64	.54	.47	...
	(1.14)	(1.33)	(1.46)	(1.24)	(1.73)	...
Preindustry	.00	.14	.18	.18	...	...
	(.00)	(.26)	(.36)	(.28)	...	...
Log age	−1.44	−1.63	−1.65	−1.68	−1.74	−1.20
	(−2.28)	(−2.54)	(−2.58)	(2.62)	(−2.77)	(−2.05)
Discretionary Budget	...	−.25	−.18	−.26	−.22	...
	...	(−1.70)	(−1.41)	(−1.77)	(−1.64)	...
DBUDGET*ETHICS	...	.20	...	.30	.35	...
	...	(.58)	...	(.88)	(1.11)	...
Ethics bill	−.55	−.48	−.53	−.04	...	...
	(−1.43)	(−1.23)	(−1.38)	(−.13)	...	...
Post-1965	.64	.63	.66	...	...	...
	(2.04)	(1.96)	(2.09)	...	...	...
Republican	−.38	−.35	−.37	−.13	...	...
	(−1.46)	(−1.24)	(−1.44)	(−.51)	...	...
Unemployment	−.01	−.03	...	−.03	...	...
	(−.34)	(−.87)	...	(−.89)	...	...
Female	−1.19	−1.16	−1.14	−1.13	−1.20	...
	(−1.76)	(−1.67)	(−1.66)	(−1.66)	(−1.84)	...
Log-Likelihood	−80.22	−78.71	−79.27	−80.70	−81.28	−86.62
χ^2	12.80*	15.82*	14.70*	11.84	10.68**	...
Degrees of freedom	7	9	7	8	4	...

NOTE.—Asymptotic t-statistics are in parentheses; see text for explanation of test.

* Rejects restriction at 10 percent.

** Rejects restriction at 5 percent.

ture the effects of various exogenous variables. General business conditions are proxied by the unemployment variable; the patronage and preindustry dummies capture the regulatory selection process; the Republican dummy captures any possible effects across different administrations; the post-1965 dummy captures the effect of the increase in regulations that followed the mid-1960s; the ethics dummy captures the effect of the ethics bill of 1978; the female dummy captures any potential sex differences in career paths, while the DBudget*Ethics variable captures the change in the cost of industry transfers following the ethics bill.

Column 1 of table 6 shows the results of estimating the probit equation where the set of explanatory variables does not include any of the budget variables. Patronage appointments and younger regulators have a higher probability of obtaining a regulated industry job; Republican administrations seem to reduce the probability of regulators working for the regulated industry; female commissioners go to work for the regulated industry in much lower proportions than their male colleagues;[86] and the ethics bill seems to have reduced the probability of working for industry.

Column 2 presents the estimation of the probit equation when all the variables are included, and columns 3–6 perform robustness tests by excluding selected variables.[87] Here, increases in discretionary budgets seem to reduce the probability of going to work for the regulated industry. The effect of discretionary budgets seems to differ following the ethics bill of 1978. While the change is insignificant, it is positive, implying that the effect of discretionary budgets may have fallen following the passage of the ethics bill. Macroeconomic considerations do not seem to significantly affect the decision to go to work for the regulated industry. Finally, the probability that regulators leaving their commissions obtain regulated industry jobs seem to be smaller during Republican administrations. This result may suggest either that Republican administrations enforce the conflict-of-interest laws more stringently or that they are able to lure regulators with better alternative compensations, thus reducing industry's ability to make transfers to regulators.[88] Column 6 presents the results of estimating the probit equation, excluding all variables except for age. This version is useful in order to test whether the coefficients of all other

[86] There are, though, only seven female commissioners in my sample.

[87] Since cols. 2–5 present qualitatively similar results, I will proceed with the discussion based on the results of col. 2. From col. 4, however, we see that the results concerning the ethics bill and the Republican coefficients (but not the coefficient of DBudget*Ethics) are sensitive to the inclusion of the post-1965 variable. Thus, inferences about the independent role of the ethics bill and of the party should be made with caution.

[88] See, however, col. 4, where this result does not hold if the post-1965 variable is excluded.

variables are, jointly, statistically significant. A χ^2 test is performed for each of the specifications in the table, with the results and the degrees of freedom being reported at the bottom of the table. The restriction that all coefficients, except for age, are jointly equal to zero is rejected at normal confidence levels. While the estimated coefficients are all of the predicted sign, and are jointly statistically significant, few estimates are, on their own, statistically significant at the percent level. With that caveat, these results suggest that discretionary budgets and postagency employment at the regulated industry are negatively correlated, with the correlation being reduced following the passage of the ethics bill.[89] Furthermore, the effect of discretionary budgets is not small. For example, at the sample mean, an abnormal budget increase of one standard deviation would increase the probability of postcommission employment at the regulated industry by approximately 9 percentage points, implying a 20 percent increase in the probability of regulated industry employment.[90] Congress, then, seems to have used budgets to discipline its regulators.

X. Final Comments

In this article I present a multiple-principals/single-agent model of regulation. The model provides a framework to analyze Congress's incentives

[89] Observe that such a negative correlation will also arise even if Congress were to prohibit industry transfers. Lemma C1 implies that unfavorable regulatory outcomes (for Congress) are followed by lower budgets. Furthermore, if Congress is dissatisfied with the performance of commissioners, it will also restrict their future public employment. Thus, commissioners leaving the agency during periods of unusually low budgets would have a lower probability of finding public postcommission employment, and the probability of obtaining a private postcommission employment is increased. If the regulated industry does not provide transfers to regulators, then the determinants of the probability of moving to either a regulated or a nonregulated industry position should be the same. Consequently, the finding of a negative correlation does not necessarily provide support for the multiple-principals model, though it does for a single-principal (Congress) agency framework. A preliminary test of the single-principal hypothesis against the multiple-principals hypothesis can be performed by estimating the model of Table 6, col. 2, where the dependent variable is the probability of going to work for the nonrelated private sector. The estimated equation shows a positive and significant coefficient (t-statistic of 2.1) for the discretionary budget variable. Thus, the determinants of postcommission employment at the regulated and nonrelated private sector are different. While for the latter the human capital hypothesis may be relevant, that does not seem to be the case for the former. Thus, the data seem to provide some indirect support for the multiple-principals hypothesis against the single-principal hypothesis.

[90] The calculation of the change in the probability is as follows: dProb = $f(x\beta)$*coefficient*dx, where f(·) is the normal density function. Recall that, by construction, the standard deviation of the discretionary budget variable is one. Thus, $dx = 1$. Thus, the effect of a change in the discretionary budget of one standard deviation is simply the coefficient, $-.25$, times the value of the density function at the sample mean, .353, to give 8.83 percent. Also, the probability of postindustry employment at the sample mean is 45 percent.

to regulate industries, as well as to restrict the ability of interest groups to influence the outcomes of the regulatory process. It also provides empirically testable implications different from the traditional self-interest hypothesis. The empirical evidence provided here does not reject the existence of an agency problem between Congress and its regulatory agencies. While Congress seems to use its budgets to discipline regulators, congressional control does not seem to be perfect.

APPENDIX A

Statement of the Game

When Congress allows industry transfers to the regulator, then the solution to the game played by Congress, industry, and regulators is as follows.

The equilibrium is a triple $(\mathbf{B}, \mathbf{T}, x)$, with $\mathbf{B} = (B_l, B_h)$, $\mathbf{T} = (T_l, T_h)$, such that

$$x = \underset{\{y\}}{\operatorname{argmax}} \{\phi(y)[W(B_l, y) + T_l] + [1 - \phi(y)][W(B_h, y) + T_h]\}, \quad \text{(A1)}$$

$$\mathbf{T} = \underset{\{T_l, T_h\}}{\operatorname{argmax}} \{\phi(x)(\pi_l - T_l) + [1 - \phi(x)](\pi_h - T_h)\}, \quad \text{(A2)}$$

subject to

$$x = \underset{\{y\}}{\operatorname{argmax}} \{\phi(y)[W(B_l, y) + T_l] + [1 - \phi(y)][W(B_h, y) + T_h]\},$$

and

$$\mathbf{B} = \underset{\{B_l, B_h\}}{\operatorname{argmax}} \{\phi(x)(U_l - B_l) + [1 - \phi(x)](U_h - B_h)\}, \quad \text{(A3)}$$

subject to

$$x \text{ solves (RP)},$$

$$T \text{ solves (IP)},$$

and

$$\phi(x_0)W(B_l, x_0) + [1 - \phi(x_0)]W(B_h, x_0) \geq w^*, \quad \text{(A4)}$$

where

$$x_0 = \underset{\{y\}}{\operatorname{argmax}} \{\phi(y)W(B_l, y) + [1 - \phi(y)]W(B_h, y)\},$$

and where w^* is the regulator's reservation utility level. That is, the solution to the game consists of simultaneously solving Congress's (eq. [A3]), industry's (eq. [A2]), and the regulator's (eq. [A1]) problems. The regulator's problem (eq. [A1] consists of maximizing its expected utility, subject to Congress's and industry's offers. Industry's problem (eq. [A2]) consists of maximizing its expected profits net of transfers, subject to Congress's budget offer and the regulator's first-order condition. Finally, Congress's problem (eq. [A3]) involves maximizing expected consumer surplus net of budgets, subject to (*a*) the regulator's optimal choice of x for any given set of budget and transfer offers, (*b*) the industry's optimal choice of transfers for any set of budget offers, which in turn depends on the optimal regulator's choice of effort, and (*c*) the regulator's individual rationality constraint evaluated at a level of zero industry transfers.

APPENDIX B

Full Information Regulatory Policy

When no industry transfers are allowed, and x is observable, Congress's first-best outcome is obtained by solving equation B1:

$$\max_{\{B_l, B_h, x\}} \{\phi(x)(U_l - B_l] + [1 - \phi(x)](U_h - B_h)\}, \tag{B1}$$

subject to

$$\phi(x)[W(B_l, x)] + [1 - \phi(x)]W(B_h, x) \geq w^*.$$

Congress's first-best outcome is given by lemma B1.

Lemma B1. In the absence of industry influence in the regulatory process, the full information effort and budget allocations are given by

$$B_l = B_h = B, \tag{B1i}$$

$$W(B, x) = w^*, \tag{B1ii}$$

$$W_x(B, x)/W_B(B, x) = -\phi'(x)(U_l - U_h). \tag{B1iii}$$

The proof of the lemma is straightforward and is not presented. The intuition is discussed in the text.

APPENDIX C

The solution to the "no industry transfers" equilibrium is characterized by lemma C1.

Lemma C1. The solution to (7) and (6) is given by

$$B_l > B_h \geq 0, \tag{C1i}$$

$$\text{if } \delta \leq 1/W_B^h, \text{ then } B_h = 0, \tag{C1ii}$$

$$W_B^l/W_B^h = -\phi(1 - \delta W_B^l)/[(1 - \phi)(1 - \delta W_B^h)] \quad \text{for } B_h > 0, \tag{C1iii}$$

$$\phi = 0 \Rightarrow B_l = 0, \tag{C1iv}$$

where δ is the Lagrange multiplier associated with the regulator's individual rationality constraint and W_B^j represents the derivative of $W(B, x)$ with respect to B evaluated at B_j. The proof of lemma C1 is similar to that of lemma 1 and is not given here.

APPENDIX D

Proposition D1. In the absence of industry transfers,

(i) the full information regulatory effort level is achievable if and only if

$$\phi(x^*)(U_l - U_h)W_B(B^*, x^*) \leq w^* - W(0, x^*). \tag{D1}$$

(ii) Furthermore, if equation (D1) holds, then

$$B^* < \phi(x^*)B_l(x^*) + [1 - \phi(x^*)]B_h(x^*),$$

where (B^*, x^*) represent the first-best combination of budget and regulatory effort and $B_j(x^*)$, $j = l, h$, represent the budget allocations needed to implement x^* in the restricted game.

The proof of proposition D1 involves finding a pair (B_l, B_h) so that x^* can be implemented as an equilibrium to the restricted game. Since in principle B_l can be adjusted so that the regulator receives no rents, condition (D1) requires that the highest feasible punishment Congress can impose (a zero budget) should provide the regulator with a substantial relative disutility (compared to his reservation utility level) that will motivate him to undertake the optimal effort. Furthermore, since the regulator's expected utility equals w^*, assumption (1) implies point ii.

APPENDIX E

PROOF OF LEMMA 1. Industry first-order conditions are given by equations (E1):

$$x_{Tl}\phi'(\pi_l - T_l - \pi_h + T_h) - \phi + \xi_{Tl} = 0, \quad \xi_{Tl}T_l = 0, \tag{E1a}$$

and

$$x_{Th}\phi'(\pi_l - T_l - \pi_h + T_h) - (1 - \phi) + \xi_{Th} = 0, \quad \xi_{Th}T_h = 0, \tag{E1b}$$

where $x_{Tl} = -\phi'/W_{xx}$, and $x_{Th} = \phi'/W_{xx}$ are derived from the regulator's first-order conditions. Equations (E1) imply $T_l = 0$ since, for an internal solution, $\Delta\Pi > Th - T_l$. That $B_l > B_h > 0$ can be derived from the first-order conditions for Congress that are given in (E2):

$$-\phi'^2(\Delta U - B_l + B_h)W_B^l/(2W_{xx}) - \phi(1 - \delta\phi^0/\phi W_B^l) + \xi_{Bl} = 0, \quad \xi_{Bl}B_l = 0, \tag{E2a}$$

and

$$\phi'^2(\Delta U - B_l + B_h)W_B^h/(2W_{xx}) - (1 - \phi)[1 - \delta W_B^h(1 - \phi^0)/(1 - \phi)] + \xi_{Bh} = 0, \quad \xi_{Bh}B_h = 0. \tag{E2b}$$

Rearranging (E2a) and (E2b), we obtain $W_B^l \le W_B^h$, implying $B_l \ge B_h$. Observe that as long as $T_h > 0$, $B_l > B_h$ since $\phi^0 > \phi$ for $T_h > 0$. The derivation of equation (iii) is straightforward from (E2b). To see that $\phi = 0 \Rightarrow B_l = 0$, assume an equilibrium with $x = \phi = 0$ but $B_l > 0$. Then, by reducing B_l, Congress will experience no reduction in x and a welfare increase because of a budget reduction. Equation (v) is derived directly from corollary 1.

APPENDIX F

PROOF OF PROPOSITION 1. Assume that x^0 is the equilibrium regulatory effort. (B_h^0, B_l^0) and T_h^0 are spent to achieve that outcome. We want to show that the expected total amount, $\phi(B_l^0 + T_l^0) + (1 - \phi)(B_h^0 + T_h^0)$, exceeds the minimum required to obtain x^0, where the probability function is evaluated at x^0. The first-order conditions to minimize total expected expenditures subject to the individual rationality constraint and $x(B_l, T_l, B_h, T_h) = x^0$ are given by

$$\phi - \gamma x_{Bl} - \delta\phi W_B^l - \xi_{Bl}^M = 0, \quad \xi_{Bl}^M B_l = 0, \tag{F1}$$

$$\phi = \gamma x_{Tl} - \delta\phi - \xi_{Tl}^M = 0, \quad \xi_{Tl}^M T_l = 0, \tag{F2}$$

$$(1 - \phi) - \gamma x_{Bh} - \delta(1 - \phi)W_B^h - \xi_{Bh}^M = 0, \quad \xi_{Bh}^M B_h = 0, \tag{F3}$$

and

$$(1 - \phi) - \gamma x_{Th} - \delta(1 - \phi) - \xi^{M}_{Th} = 0, \quad \xi^{M}_{Th} T_h = 0, \tag{F4}$$

where δ (γ) is the Lagrange multiplier associated with the individual rationality (constant effort level) constraint. Observe first that $W^l_B = 1$ is a solution to this problem. Since $x_{Th} < 0$ and $1/W^h_B \leq \delta \leq 1/W^l_B = 1$, we obtain $T_h = 0$. From (F2) we obtain $\delta = 1 + \gamma\phi'/(\phi W_{xx})$, which after some substitutions implies $W^l_B = 1 < W^h_B = (1 - \phi)/[1 - \phi + \gamma\phi'/(\phi W_{xx})]$. Thus, to achieve x^0 at minimum cost, compensations should make the regulator's rate of substitution between money and budget equal to one in low-price states but larger than one in high-price states. Since this allocation differs from the equilibrium one, the latter is not a cost-minimizing solution.

APPENDIX G

PROOF OF PROPOSITION 3. Let $S^R = \{x, B_h, B_l | \phi(x)(U_l - B_l) + [1 - \phi(x)](U_h - B_h) \geq EU^{R*}\}$, where EU^{R*} represents the equilibrium expected-utility level for Congress in the restricted game. The term S^R represents the set of points in (x, B_h, B_l) that provide Congress with a level of expected utility which equals at least the level achieved in the restricted game. Call $X^R = \{x, B_h, B_l | x = x(B_h, B_l, T_h = 0)\}$ where the function $x(\cdot)$ is derived from the first-order condition for the regulator. From assumptions (1)–(5) and the definition of equilibrium to the restricted game, $X^R \cap S^R$ consists of the restricted equilibrium values for (x, B_h, B_l) and is unique. Let $X^U = \{x, B_h, B_l | x = x(B_h, B_l, T_h = T^{U*}_h)\}$, where T^{U*}_h is the equilibrium industry transfer in the unrestricted game. Since from the first-order condition for the regulator we know that $x(B_h, B_l, T_h = T^{U*}_h) < x(B_h, B_l, T_h = 0)$, then $X^U \cap S^R$ is empty. Thus, the unrestricted equilibrium cannot provide Congress with a utility level in excess of EU^{R*}.