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A BIDDING ANALYSIS OF SPECIAL INTEREST REGULATION: RAISING RIVALS' COSTS IN A RENT SEEKING SOCIETY

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A BIDDING ANALYSIS OF SPECIAL INTEREST REGULATION: RAISING RIVALS' COSTS IN A RENT SEEKING SOCIETY *,**

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I. Introduction

In this paper we bring together two strands of intellectual development in order to gain a better understanding of the process through which firms attempt to realize rents by obtaining regulation which improves their competitive position. One of the two bodies of work upon which we draw deals with a phenomenon known as "rent seeking," by "special interest" regulation. It focuses on the efforts of private agents to gain rents by blocking entry through governmental action.[1] The other literature deals with a phenomenon known as "raising rivals costs" by which agents use private means to gain monopoly power by disadvantaging rivals.[2] We follow the important earlier work of Oster (1982) by stating precisely the relationship between these two areas.

The typical examples considered in the rent seeking literature are tariffs and quantitative restrictions as well as explicit entry requirements associated with regulation in areas like communications, transportation and banking. The theory underlying this work would, however, also extend to a wide variety of government regulations which have the effect of disadvantaging established competitors and deterring entry.

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[1] For example, see Tullock (1967), Stigler (1971), Peltzman (1976), Posner (1974), Maloney and McCormick (1982), Maloney, McCormick and Tollison (1979), Ackerman and Hassler (1981), and the papers presented at this conference and referenced therein.

[2] Salop and Scheffman (1983, 1984), Salop (1979), Rogerson (1984) and the papers in Salop et al (1981).

Examples include environmental regulation and legislation imposing requirements for the safety and efficacy of food and drugs. There is, however, little determinative empirical evidence of such rent seeking, at least as the exclusive explanation for such legislation. Moreover, there is a plausible alternative explanation for this type of regulation, grounded in the theory of "market failure." Indeed, in many cases the market failure and rent-seeking explanation are not mutually exclusive. A regulation may raise consumer welfare as well as the rents accruing to a group of producers.[1] Consequently, fundamental uncertainty remains as to the relative importance of these two explanatory theories. Of course, this uncertainty can only be ultimately resolved by empirical testing, of which there has been very little. Our contribution here is to develop a testable model of rent-seeking, special interest regulation.

We draw on the second strand of analysis to help clarify this basic ambiguity. Recent work by Salop and Scheffman and others focuses on the potential strategies by which firms can disadvantage rivals to gain monopoly profits by employing exclusionary strategies which increase the costs of competitors relative to its own. This analysis identifies the industry characteristics which make such an exclusionary strategy profitable and the means by which relative costs can be manipulated in

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[1] Regulatory charges that raise consumers welfare invariably redistribute rents as well.

order to secure the desired monopoly profits. This analysis has obvious relevance in devising an analytic approach for determining whether a given regulation is the product of rent seeking by firms in the industry or, alternatively, represents an effort to cure market failures. Analytically, it makes no difference whether rivals' costs are raised privately or by government intervention. The same conditions for pursuing this strategy successfully hold in both cases. Thus, if the particular regulation does not constitute a plausible means of raising rivals costs and securing monopoly profits, the rent seeking explanation can be ruled out. This would not, of course, prove the market failure theory. But acceptance or rejection of the rent seeking explanation nevertheless represents significant progress in developing a theory identifying the forces which really account for the introduction of regulation.

Our contribution lies primarily in clarifying the demand by firms for such cost-raising regulations. These demands are determined by the structure of the industry and the nature of the regulation. Thus, we show how any given regulation will vary in value to different firms according to the characteristics of industry demand and supply, and the relative effect of the regulation on the costs of the firms in the industry. By the same token any particular firm will value various types of regulation differently, depending on the structure of the industry in which it functions and its position in that industry.

Our application of this strategic analysis to a regulatory context follows (Nelson (1957), Williamson (1968) and Oster (1982)). We are able, however, to generalize the analysis and explain with greater precision how the characteristics of a regulation in conjunction with the cost and demand characteristics of the industry determine the gains and losses which firms and groups of firms will experience when a regulation is introduced. These gains and losses then provide a basis for predicting how much various firms would pay to obtain the regulation or, alternatively, to prevent its introduction.

However, for this analysis to be utilized to predict which regulations are adopted it would also be necessary to specify the institutional setting in which regulations are "supplied" and "purchased." Our contribution here is more modest and our conclusions much more tentative because the difficult task of carefully defining the institutional setting in which regulations are supplied--i.e., proposed and adopted--is beyond the scope of our present inquiry. It seems clear, however, that no matter what ultimately proves to be the correct institutional specification that the gains and losses accruing to various parties upon which we focus will be important factors in determining what regulation is introduced.

We do make some contribution to an understanding of how the rivalry to capture the potential gains and avoid the potential losses, as determined by industry structure and the position of

the individual firm, is constrained by the prevailing institutional structure. This is done by postulating one polar institutional setting in which the firm or firms securing favorable regulation must pay a price equal to the losses suffered by the firms disadvantaged by the regulation. The notion here is that the beneficiaries must outbid their rivals by paying a price in excess of the amount which the disadvantaged group would pay to prevent the introduction of the regulation. In this case, we are able to obtain an interesting condition governing the successful adoption of regulation by a rent-seeking, special interest group. This condition, which we call the strong rent-seeking, special interest result, states that the dominant coalition will propose and successfully implement the "cartel" regulation, that is the regulation that maximizes joint industry profits. This bidding model then embodies a mechanism for achieving the same result as would be reached through collusion by a process which is perfectly competitive, subject, of course, to the prevailing institutional constraints.

We turn then first to our principal contribution to this puzzle--specifying the gains and losses of the actual and potential firms in the industry resulting from the introduction of a new regulation. After examining this question, we consider the implications of various assumptions about to how regulation is actually effected.

II. The Model of Regulation

We begin with an abstract, formal model of regulation. Regulation is formalized by the parameter r, where increases in r are interpreted as increases in regulation. We follow the convention that increases in r increase some of the producers' costs of production. Thus, the parameter r could proxy tightening of emissions standards for power plants, increased safety standards for automobiles, increased advertising substantiation requirements, or adoption by building codes of a standard that prohibits use of certain substitute products.

Suppose the regulation involves a market with two groups of competitors, A and B. We will discuss the determinants of the members of group A and B below. Our formal notation is given as follows:

Notation

r	Regulatory Parameter
a	Output of Group A
b	Output of Group B
p	Market Price
Q	Total Output
D(p)	Market Demand
f(Q)	Inverse Market Demand, p = f(Q)
R(p,r)	Residual Demand for Group A

$A(a,r)$ Cost Function for Group A

$B(b,r)$ Cost Function for Group B[1]

We assume that an increase in regulation increases group B's total and marginal costs (B_2, $B_{12} > 0$) and may increase A's total and marginal costs (A_2, $A_{12} \geq 0$). We treat both the case where group A acts competitively in the output market and the case where it consists of a single dominant firm. We assume that the disadvantaged group B always acts competitively in the output market. Therefore, the supply function for B is generated by the price-equals-marginal-costs, non-negative profit condition:

$$\begin{aligned} & p = B_1(b,r) \quad , \quad B_{11} > 0 \; B_{12} > 0 \\ & pb - B(b,r) \geq 0 \end{aligned} \tag{1}$$

We will sometimes denote the supply curve for group B as $S^B(p,r)$, where $S^B(p,r)$ is derived from equation (1) and $S^B_p = 1/B_{11} > 0$, $S^B_r = -B_{12}/B_{11} < 0$. If increases in regulation increase B's marginal costs, then it necessarily reduces its supply at that price.

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[1] Let $B_j(a_j,r)$ be the total cost function for member j of group B. Assuming that group B acts competitively in the output market, then the total cost function of group B is the solution of the problem: min $\Sigma B_j(a_j,r)$, subject to $\Sigma b_j = b$ and marginal cost of firm j greater-or-equal to its average cost, i.e., $B_{j1} \geq B_j(b_j,r)/b_j$. (The last condition requires that no member of group A is operating at loss). A similar condition can be derived for competitive group A. If group A consists of a single dominant firm, $A(a,r)$ is its cost function.

A. The Effect of Increased Regulation on A's Residual Demand Curve

The residual demand curve facing A is simply the horizontal difference between industry demand and group B's supply, i.e., $R(p,r) = D(p) - S^B(p,r)$. If an increase in regulation shifts B's supply curve up to the left, this has the effect of shifting up B's residual demand curve, thereby improving its profit opportunities. To illustrate, consider first a situation in which the market demand curve is perfectly inelastic at $\overline{D}$. In Figure 1, $\overline{R}$ is A's residual demand curve for regulation $\overline{r}$. If regulation is increased to r', B's supply curve shifts back to $S^B(p,r')$ and A's residual demand curve shifts up to R'. Notice that the residual demand curve shifts up at each particular output level a for A, by exactly the upward shift in B's supply curve at output $b = \overline{D} - a$.

Consider next the case of a downward sloping market demand curve illustrated in Figure 2. In this case, the upward shift in the residual demand curve is everywhere less than the upward shift in B's supply curve. With a downward sloping demand, increases in price can only arise from reductions in aggregate output. At the extreme the reader can readily confirm that, if the market demand curve is perfectly elastic, A's residual demand curve will not shift up at all.

The extent of the vertical shift in A's residual demand curve can be derived from A's inverse residual demand curve, given by the implicit equation,

Figure 1

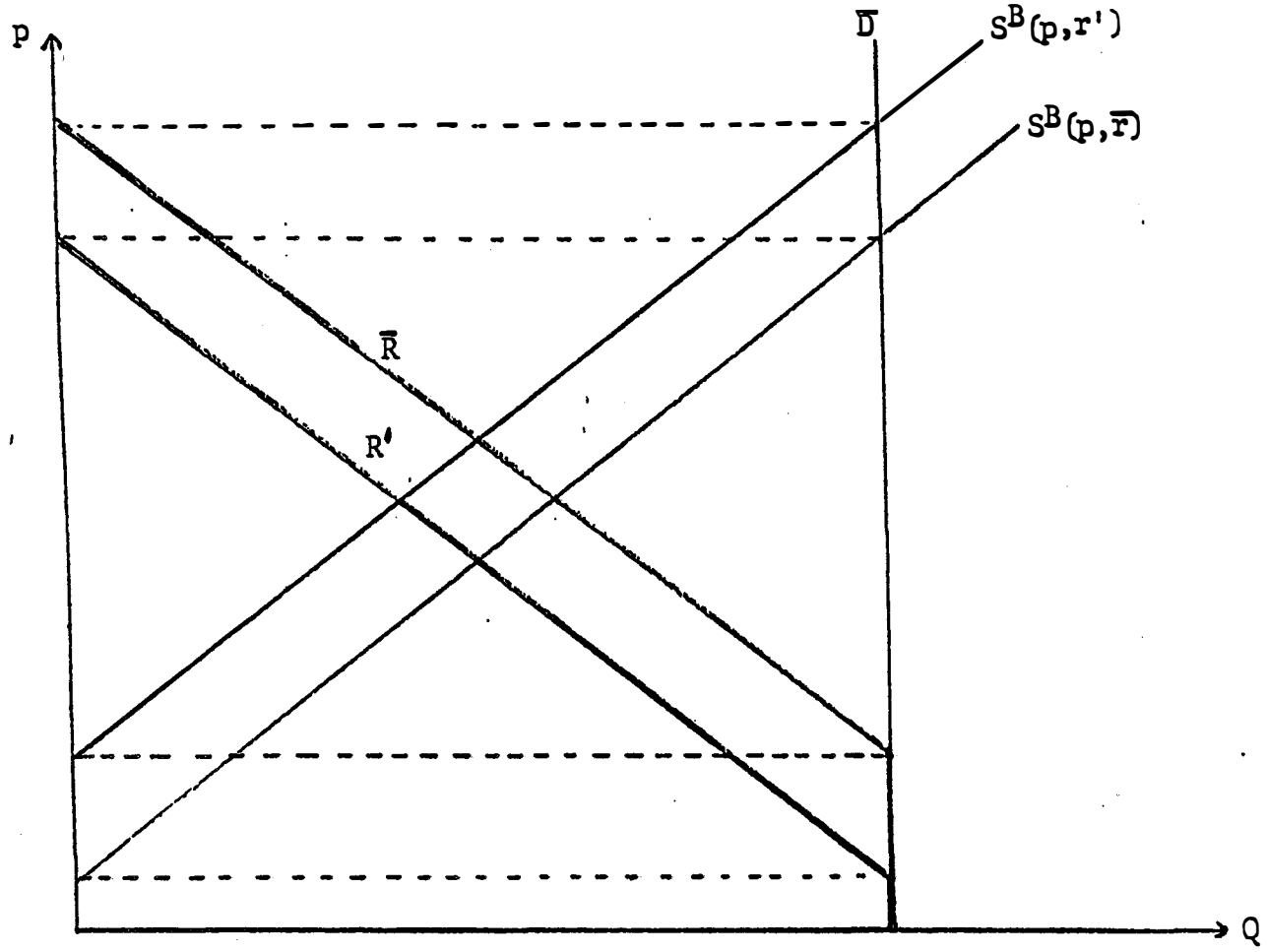
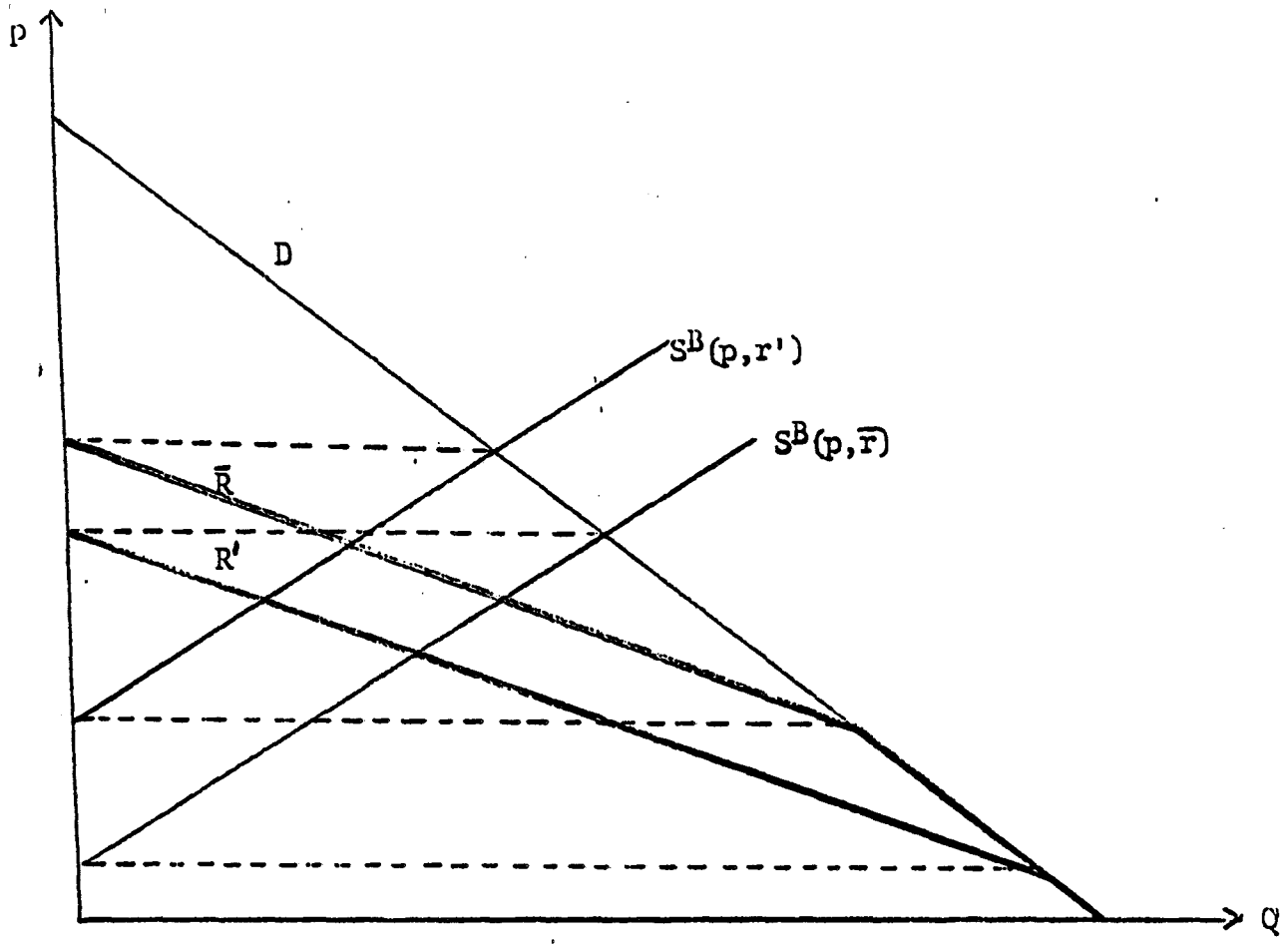


Figure 2



$$p = f(a + S^B(p,r)) \tag{2}$$

Differentiating equation (2), the vertical shift in A's residual demand curve is given by,

$$\partial p/\partial r = \frac{f' S_r^B}{1 - f' S_p^B} \tag{3}$$

As market demand becomes less elastic (-f' larger) the vertical shift in A's residual demand curve increases, approaching the vertical shift in group B's supply curve ($\partial p/\partial r = -S_r^B/S_p^B$). If market demand is perfectly elastic (-f' = 0), A's residual demand curve does not shift up at all ($\partial p/\partial r = 0$).

B. The Effects of Increased Regulation on Price, Output and Rents

In order to assess the effects of increased regulation, we must make further assumptions about the competitive structure of the market. We first will assume that the members of group A act competitively in the output market. Then, in the following section, we assume that group A consists of a single price-setting dominant firm.

1. Competitive Market

The supply function for a competitive group A involves the equality of price and marginal costs,

$$p = A_1(a,r) \tag{4}$$

We will sometimes write the supply function of group A as $S^A(p,r)$, where $S^A_p = 1/A_{11}$, $S^A_r = -A_{12}/A_{11}$.

For simplicity, we assume that equilibria involve positive outputs for both A and B. Then for any regulation r, the market equilibrium is given by the three standard equations,

$$\begin{aligned} &\text{(i)} \quad p = A_1(a,r) \\ &\text{(ii)} \quad p = B_1(b,r) \\ &\text{(iii)} \quad p = f(a+b) \end{aligned} \tag{5}$$

The effect of an increase in regulation on the equilibrium values of (p, a, b) can be determined by differentiating equation system (5) with respect to r. Although the algebra is tedious, the results are straightforward. In order to simplify, we will introduce the following notation.

Notation

ε^D	Price Elasticity of Market Demand (absolute value)
ε^A	Price Elasticity of A's Supply
ε^B	Price Elasticity of B's Supply
δ	A's Market Share (a/Q).
ε^S	Price Elasticity of Total Market (i.e., A+B) Supply ($\varepsilon^S = \delta\varepsilon^A + (1-\delta)\varepsilon^B$)

Differentiating (5), the comparative statics are given as follows:

$$(i)\quad da/dr = (\delta Q \varepsilon^A/p)\left[\frac{(B_{12}-A_{12})(1-\delta)\varepsilon^B - A_{12}\varepsilon^D}{(\delta\varepsilon^A+(1-\delta)\varepsilon^B)+\varepsilon^D}\right] \tag{6}$$

$$(ii)\quad db/dr = ((1-\delta)Q\varepsilon^B/p)\left[\frac{(A_{12}-B_{12})\delta\varepsilon^A - B_{12}\varepsilon^D}{(\delta\varepsilon^A+(1-\delta)\varepsilon^B)+\varepsilon^D}\right]$$

$$dp/dr = \frac{\delta\varepsilon^A A_{12}+(1-\delta)\varepsilon^B B_{12}}{(\delta\varepsilon^A+(1-\delta)\varepsilon^B)+\varepsilon^D} \tag{7}$$

The interpretations of (6) and (7) are straightforward. It is useful to note that the denominators of (6) and (7) equal $\varepsilon^S + \varepsilon^D$, where ε^S is the price elasticity of total market supply. If an increase in regulation shifts back the supply curve of group B ($B_{12} > 0$) and does not shift out the supply curve of group A ($A_{12} \geq 0$), equation (7) shows that the equilibrium price increases by an amount directly related to the increase in the marginal costs of the two groups (A_{12} and B_{12}) and inversely related to the demand elasticity (ε^D). The less elastic the demand curve, the more price can increase without reducing output.

The effect of the supply elasticities ε^A and ε^B is more complex. If both elasticities are equal, equation (7) is simplified considerably. Letting $\varepsilon^A = \varepsilon^B = \varepsilon^S$, we have

$$\frac{dp}{dr} = \frac{\Delta MC}{1+\varepsilon^D/\varepsilon^S}\ , \tag{7a}$$

where $\Delta MC = \delta A_{12}+(1-\delta)B_{12}$, i.e., the market-share-weighted average change in marginal cost. Thus, the higher is the common supply elasticity, the larger is the price change caused by the regulation-induced increase in marginal costs.

Since regulation increases price, if demand is downward sloping, total output must fall. Therefore, we have the following obvious result.

Result 1

In a competitive market, a cost-raising regulation increases market price and reduces output.[1]

We consider next the effect of an increase in regulation on A's and B's rents, which we denote as Π^A and Π^B, and define as follows:

$$\begin{aligned} &\text{(i)} \quad \Pi^A = pa - A(a,r) \\ &\text{(ii)} \quad \Pi^B = pb - B(b,r). \end{aligned} \tag{8}$$

Notice that, if fixed costs are zero, these rents are simply the usual producer surplus measure of rents, i.e., the area between price and the supply curve. Consider now the comparative statics of producer rents. Differentiating equation (5), we have:

$$\begin{aligned} &\text{(i)} \quad d\Pi^A/dr = a\, dp/dr - A_2 \\ &\text{(ii)} \quad d\Pi^B/dr = b\, dp/dr - B_2 \end{aligned} \tag{9}$$

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[1] We put aside the possibility that the increase in cost improves the quality of the product and, consequently, the demand for it.

Rearranging terms, we have a prediction about the effect of regulation on the rents of groups A and B

$$\text{(i)}\quad dA/dr \gtreqless 0 \text{ as } dp/dr \gtreqless A_2/a$$
$$\text{(ii)}\quad dB/dr \gtreqless 0 \text{ as } dp/dr \gtreqless B_2/b. \tag{10}$$

The interpretation of equation (10) is straightfowrard. The term (A_2/a) is the change in A's average costs from an increase in regulation, at any particular output. Therefore, the equation states that an incremental increase in regulation is profitable for A if the increase in price exceeds the increase in average cost holding A's output constant. This result can be clarified by observing that $A = (p-AC^A)a$. A similar result obtains for group B.

We now derive the conditions under which a regulation is profitable. Returning to Figure 1, if the market demand curve is perfectly inelastic, the change in price, at any fixed outputs for A and B, is equal to the sum of the vertical shifts in the supply curves of the two groups. We can define the market inverse supply function $p^S(Q,r)$ (that relates the supply price p^S to industry output Q and regulation r) by the equation,

$$S^A(p^S,r) + S^B(p^S,r) = Q \tag{11}$$

Differentiating equation (11), the increase in the supply price function for any fixed output (i.e., the vertical shift in the market supply curve) is given by

$$\partial p^S/\partial r = \frac{\delta\varepsilon^A A_{12}+(1-\delta)\varepsilon^B B_{12}}{(\delta\varepsilon^A+(1-\delta)\varepsilon^B)} \tag{12}$$

Comparing (12) and (7), it follows that $dp/dr \leq \partial p^S/\partial r$, i.e., the increase in equilibrium price cannot exceed the vertical shift in the market supply curve. Using this fact in conjunction with equation (10), we have the following necessary conditions,

$$\begin{aligned} &\text{(i)} \quad d\pi^A/dr > 0 \text{ requires } \partial p^S/\partial r \geq A_2/a \\ &\text{(ii)} \quad d\pi^B/dr > 0 \text{ requires } \partial p^S/\partial r \geq B_2/b \end{aligned} \tag{13}$$

Summarizing equation (10) and (13), we have the following result.

Result 2

An increase in regulation raises the rents of a producer group if the equilibrium price increases by more than the group's average cost. A necessary condition for such an increase in a group's rents is that the market supply curve shift up by more than the group's average cost.

We now derive a related sufficient condition. Suppose, for example, that $A_{12} = B_{12} = \Delta MC$ (i.e., the effect of increased

regulation on marginal costs is the same for A and B). From equation (12), the vertical shift in the market supply curve is equal to A_{12}, the (common) increase in marginal costs. If market demand were perfectly inelastic, ΔMC would equal the increase in market price. As a result, a sufficient condition for A to gain from the regulation would be for the common increase in marginal cost (ΔMC) to exceed the increase in A's average cost (A_2/a).

The important point revealed by this analysis is that in general, it is the effect on market marginal costs that determines the increase in equilibrium price. It is obviously the effect on average costs that determines the increase in the costs of the two groups. Therefore, it is the relative shifts in market marginal costs and individual average costs that is critical in determining the effect of an increase in rents from regulation. This can be further clarified by Figure 3, where the market supply function is assumed to be a step function. Group A's supply curve is assumed to be the segment of the market supply curve labelled S, and group B's supply curve is assumed to consist of the segments T and U.

An increase in regulation that raises B's costs will only increase the market price if it shifts up the U segment of the market supply curve.[1] Increasing the costs of the marginal units of output raises the market price. This has two important

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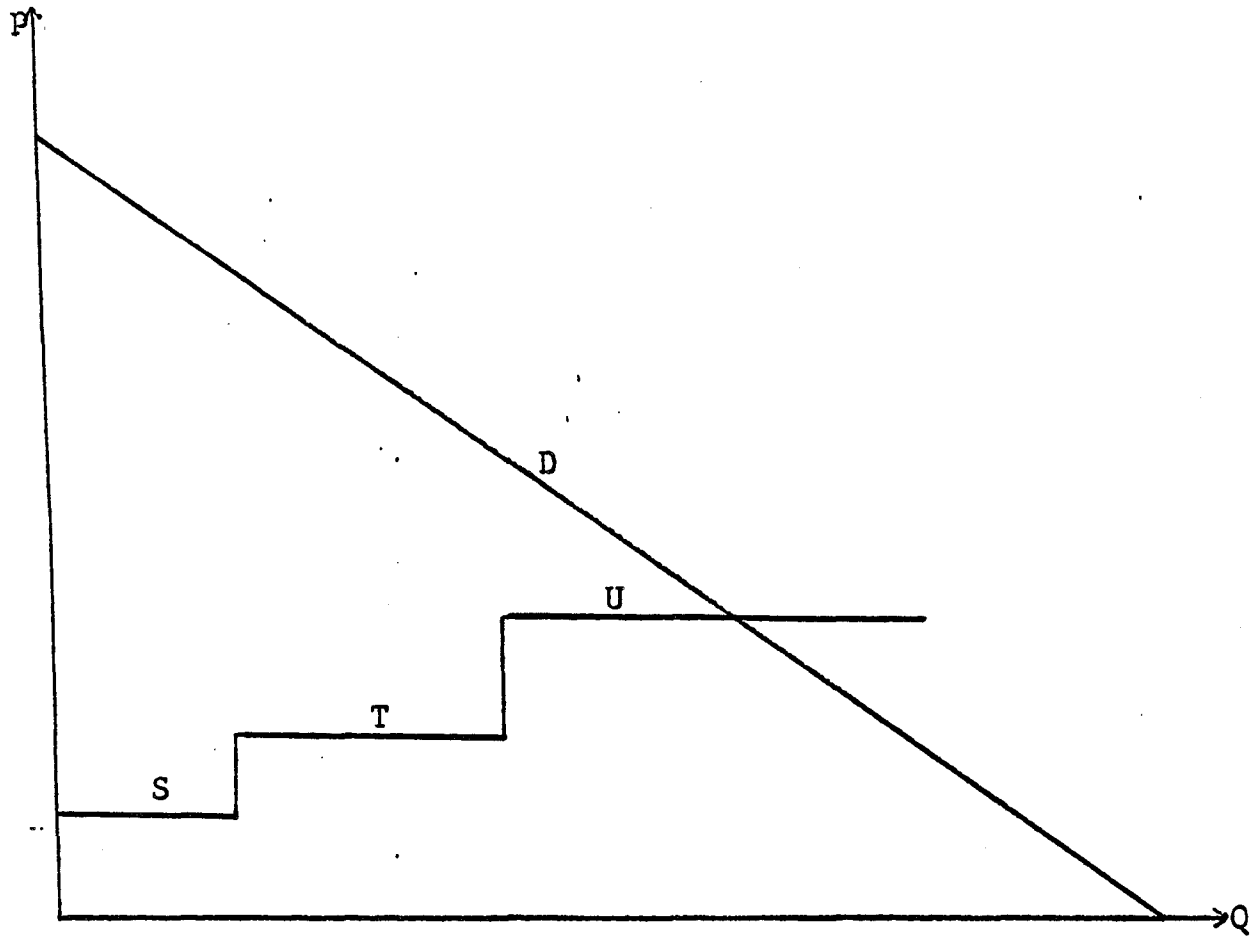
[1] Of course, as an alternative, the market price would rise if the regulation shifts up the T segment by so much that it rises above the U segment.

Figure 3



implications. First, profitable regulations are ones that increase rivals' marginal costs.[1] Second, because marginal units earn no rents, to the extent that a regulation increases rivals costs only on marginal units, producers of these marginal units may not lose significant rents as a result of the increase in regulation. For example, assuming that group B has no sunk costs, an increase in regulation that shifts up the U segment in figure 3 leaves B no worse off after the regulatory change. Group B earns "normal" (or "zero") profits on the U-units in either case, because the price rises by the amount of their cost increase.

Consider next a different interpretation of Figure 3. Suppose that the two segments S and U together represent A's production, and T represents B's production. In this case, A can gain by an increase in regulation that increases the costs of its marginal units (segment U). Indeed, in this case such a change in regulation is better for A than a change in regulation that increases B's costs! This occurs for two reasons. First, the market price rises by the full amount of the increase in the cost of A's marginal units. Second, because group A sets output competitively, it cannot, by assumption, create monopoly profits by agreeing to reduce its output. In this case, the regulation serves as a substitute for such an agreement. In terms of

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[1] Note that for a potential entrant, a change in average cost affects its entry decision. Thus, entrants' average costs are "marginal costs" for the purposes of our analysis.

residual demand, an increase in regulation can be profitable for A even if the increase in regulation does not shift up A's residual demand curve.

Taking this analysis a step further, both A and B might gain from an increase in regulation. For example, if A's supply in Figure 3 is given by the segments S and U, an increase in the cost of A's marginal units would benefit both A and B. In general, both can gain if the increase in their costs of marginal units exceeds the increase in costs on their inframarginal units. Summarizing, we have the following result.

Result 3

> Both A's and B's rents can increase from cost-increasing regulation if the regulation increases market marginal cost more than both A's and B's average costs. Similarly, it is possible for group A to benefit from a regulation that increases only its own costs.

Consider next the effect of regulation on A's and B's output. Recalling Result 1, an increase in regulation must increase market price and, because demand is downward sloping, total output must fall. Therefore, either A's or B's output must fall. Of course, one group's output may rise from the regulation. For example, in equation (6), da/dr can be positive if $(B_{12}-A_{12})$ is sufficiently positive; in particular, if $A_{12} = 0$, then $da/dr > 0$. This is an obvious result. If the regulation shifts up only B's

supply curve, the market price will rise and A's output will increase. Thus, equation (6) implies that A's output may increase if the vertical shift in B's supply curve is sufficiently greater than the vertical shift in A's supply curve. An analogous result obtains for B.

Unfortunately, changes in A's or B's rents resulting from changes in requlation cannot be inferred solely from changes in their outputs. For example, an increase in regulation might reduce A's output, increase B's output, but increase A's rents and reduce B's rents. Such counter-examples can easily be constructed.[1] Summarizing, we have the following result.

Result 4

> An increase in regulation must reduce the output of A and/or B. However either A's or B's output may rise. Changes in output do not necessarily predict changes in rents.

The gains and losses to A and B from increased regulation can be bounded as follows. From equation (9), because the regulation must increase the market price, the reduction in B's

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[1] A counterexample can be constructed graphically by postulating a change in regulation that shifts A's supply curve back to the left but makes it perfectly inelastic and shifts B's supply curve up to the right but makes it perfectly elastic. Because a perfectly elastic post-regulation supply curve implies zero rents, and changes in output are determined by marginal costs and changes in rents are determined by average costs, a counter-example can easily be obtained.

rents cannot exceed the increase in that group's total costs at its original output level.[1] Thus, the following result obtains.

Result 5

> The decrease in a group's rents resulting from a regulation is no larger than the increase in that group's total costs at its original output level.

Similarly, the gain to either group from an increase in regulation cannot exceed the increase in gross revenues that would result from the increase in the market price and outputs at the post-regulatory output levels.[2] Graphically, this corresponds to the increase in producers surplus arising from the increase in market price measured relative to the pre-regulation supply curve. This yields the following result.

Result 6

> The increase in a group's rents resulting from a regulation is no larger than the increase in that group's gross revenues calculated at its post-regulation output level.

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[1] For a finite regulatory change, let r_0 and r_1 be the old and new regulations respectively. Then $\Delta\pi^A = p^1a_1 - A(a_1,r_1) - [p^0A_0 - A(a_0,r_0)] \geq p^1a_0 - A(a_0,r_1) - [p^0a_0 - A(a_0,r_0)] \geq A(a_0,r_0) - A(a_0,r_1)$.

[2] Following the previous footnote, we have $\Delta\pi^A \leq p^1a_1 - A(a_1,r_1) - [p_0a_1 - A(a_1,r_0)] < (p^1-p^0)a_1$.

2. Dominant Firm Model

In the preceding section, we assumed that both A and B act competitively in the product market, i.e., their outputs are determined by the usual price-equals-marginal-cost condition. In this section, we modify that model. We continue to assume that group B acts competitively. However, we now assume that group A consists solely of a single dominant firm or a perfect cartel. This means that A perceives that its residual demand is not perfectly elastic and sets its output accordingly to maximize its profits. This is in contrast to the competitive model where the equilibrium is determined by the intersection of A's supply curve and its residual demand curve. In the dominant firm model, A chooses its output to maximize its profits, given its residual demand curve and cost function. Instead of setting price equal to marginal cost, A chooses its output to equalize the marginal revenue (from its residual demand curve) and marginal costs.[1]

Formally, equation (5) is now replaced by the following optimization problem.

$$\max_{\{p\}} \; pa - A(a,r)$$

where (14)

$$a = D(p) - S^B(p,r)$$

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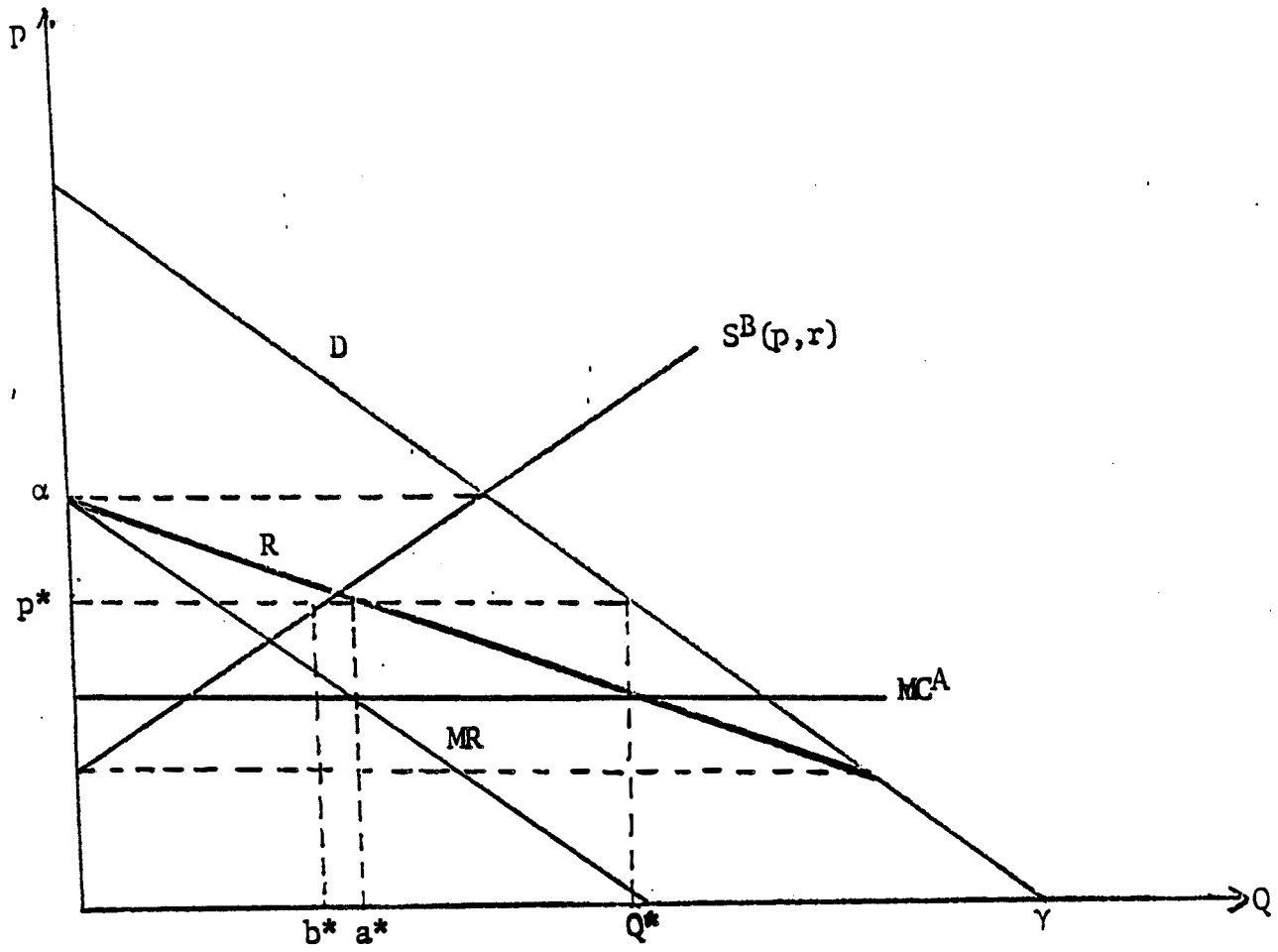
[1] See Salop and Scheffman (1984) for a detailed analysis of this model.

An equilibrium in the dominant firm model is depicted in Figure 4, where R is A's residual demand curve facing A, MC^A is A's marginal cost curve and MR is the marginal revenue corresponding to its residual demand curve.

In analyzing this model, it is useful to recall the earlier discussion that showed how an increase in regulation affects A's residual demand curve. A gains from regulation if the market price rises by more than its average costs. However, unlike the competitive model, the change in market marginal costs is not the critical determinant of the change in market price. Instead, if A is a dominant firm or cartel, it can set the market price. Therefore, A gains if the vertical shift in its residual demand curve exceeds the increase in its average costs, but where the vertical shift in A's residual demand curve is related solely to the increase in B's marginal costs. A necessary condition for A to gain is that B's marginal costs increase by more than A's average costs. Moreover, unlike the competitive model, A cannot benefit solely from an increase in its costs alone, ceteris paribus. This is because a dominant firm is able fully to control its output. Thus, it derives no gain from regulations that "cartelize" solely by reducing its own output.

Figure 4



It is easy to derive the comparative statics of the dominant firm model. Differentiating the first order conditions for equation (14), we have[1]

$$dp/dr = - \frac{-A_{12}(D'-S_p^B)-(p-A_1)S_{pr}^B-S_r^B}{2(D'-S_p^B)+(p-A_1)(D'-S_{pp}^B)} \qquad (15)$$

From the second order conditions for (14), the denominator is negative. In order to evaluate the numerator, we recall the assumptions that $S_r^B<0$, and $A_{12}\geq 0$, which imply that $(A_{12}(D'-S_p^B)+S_r) < 0$. Thus, if $S_{pr}^B \leq 0$, then $dp/dr > 0$, i.e., price increases if the increase in regulation makes B's supply curve steeper. However, if S_{pr}^B is sufficiently positive, it may be the case that $dp/dr < 0$, i.e., price could fall if the increase in regulation makes B's supply curve sufficiently flatter.

Summarizing briefly, the main differences and similarities between the competitive and dominant firm models are as follows: (1) the dominant firm A can, by definition, control its output, so, unlike a competitive group, it cannot gain solely from an increase in its own costs; (2) the dominant firm's profitability is governed by the upward shift in its residual demand curve (determined by the change in B's marginal costs, not market marginal costs), relative to the increase in its average costs;

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[1] The first-order conditions are given by $(D-S^B) + (p-A_1)(D'-S_p^B) = 0$.

(3) it is possible, but unlikely, that an increase in regulation can cause a price reduction and an increase in industry output in the dominant firm model; (4) in either model, B is not necessarily injured by an increase in regulation that is profitable for A.

The analysis that follows generally applies to both the competitive and dominant firm market structures.

C. Summary

We have now analyzed the effects of regulations with particular characteristics on the profits of various firms in an industry with a particular set of demand and supply characteristics. Depending on the set of industry and regulatory structural characteristics, rent seeking behavior will be more or less profitable to the various firms and groups of firms within the industry.

It seems reasonable to assume that the more profitable (in aggregate) is a particular regulatory change, ceteris paribus, the more likely that the change will be implemented. Obviously, however, the exact outcome will depend on the particular political and institutional structure of the regulation "marketplace." But, for any institutional structure defining the "supply" of regulation, these characteristics will be important data in predicting the type of regulations adopted and the type of industries where rent-seeking is more or less likely to be successful. We now briefly summarize the effects of these regulatory and industry characteristics.

1. Regulatory Characteristics:

(a) Effect on Marginal Cost (A_{12}, B_{12})

The greater is the regulation-induced increase in the marginal costs of the firms in the industry, the greater is the resulting industry price increase. A higher price, ceteris paribus, raises the profits of all firms, leading to a greater likelihood that such regulations will be adopted.

(b) Effect on Average Costs (A_2/a, B_2/b)

The greater is the regulation-induced increase in the average costs of a group, the less profitable will be a regulatory change to the firms in that group. In a sense, a rise in average costs is the price firms pay for the price-increasing rises in marginal costs. Thus, regulations that raise marginal costs relative to average costs are more likely to be profitable.

2. Industry Characteristics:

(a) Demand Elasticity (ε^D)

The less elastic is market demand, the greater are the potential rents that can be earned in the industry. Moreover, the less elastic is the demand the greater will be the price rise resulting from any particular regulation-induced increase in marginal cost, and so the more profitable will be any particular regulation to all firms in the industry, including those whose costs are raised by the regulation.

(b) Supply Elasticity (ε^S)

The greater is the elasticity of supply of firms in the industry, the greater will be the increase in price resulting from any particular regulation-induced increase in marginal costs. Moreover, if the firms disfavored by the regulation are the marginal producers who have a relatively elastic supply, then the regulation will reduce their rents by less. This is because, when supply is elastic, no inframarginal profits (quasi-rents) are earned. As a result, there is little inframarginal profit to lose when a regulation increases the group's marginal costs.

III. The Market for Regulation

Up to now we have discussed the industry and regulatory characteristics that determine the value of regulation to "special interest," "rent-seeking" firms in a regulated industry. In this section, we study the effect of alternative political and institutional structures on the regulatory proposals that are successfully adopted. We derive conditions governing the strongest form of the rent-seeking, special interest hypothesis--that equilibrium in the market for regulation involving maximization of joint industry profits, i.e., adoption of the "cartel" regulation.

A. Efficiently Raising Rivals' Costs

We have already calculated the effects of regulatory change on firms in an industry and analyzed the conditions under which a regulation benefits different producer groups. In this section,

we make the adoption of the regulation an endogenous variable. In particular, we develop models of regulatory change where firms make bids in order to increase (or decrease) the likelihood of regulatory change. These bids might include lobbying and litigation expenses, legal and economic reports, and campaign contributions; alternatively, they may consist of credible threats to undertake such expenditures. Although these "bidding" models are not sophisticated game theoretic models, they do capture some important elements of that more rigorous analysis and lead to a strong set of necessary and sufficient conditions.

When group A must outbid group B for effecting a regulatory change, its decision calculus must somehow incorporate the losses suffered by group B as well as the gains enjoyed by itself. This is because in the absence of free rider problems, group B would be willing to "bid" up to its total losses in order to defeat the implementation of the regulatory change.[1] Thus, when it must pay an implementation cost related to the costs it imposes on B, A must try to raise its rivals' costs in an efficient manner. This leads to a tradeoff between A's operating profits after the regulation is in place and the sum which it must pay to buy the regulation. Stated another way, group A bears two types of costs associated with the regulation: (1) the added compliance costs imposed by the regulation, i.e., the direct costs borne ex post, and (2) the amount it must pay for the regulation, ex ante, which

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[1] This assumes group B rationally anticipates its losses.

are related to the additional ex post losses imposed on the disadvantaged group. A's objective is to maximize its profits.

There are two steps to this profit-maximization. First, the losses to B must be minimized for any gain to A. Second, the level of the losses to B must be efficiently balanced against the gains to A. As discussed earlier, it is the supply of the mostly costly, marginal units that constrain A's pricing. Raising the cost of the less costly inframarginal units deprives B of profits but does not increase the profits of A. As a result, if costs can be imposed on B only at the margin, the bid which B would make to defeat the regulation is reduced. Consequently, the bid required by A to secure the regulation can be reduced accordingly.

It is also efficient to raise only the cost of marginal units by disadvantaging potential entrants rather than established competitors. On average, firms already established in the industry earn greater rents, than do potential entrants, when the rents are evaluated at a particular moment in time. To the extent that costs are sunk, there is no opportunity cost associated with employing these resources in the industry. By contrast, new entrants must incur these sunk costs in order to enter. Consequently, increases in variable costs impose greater losses on existing firms than potential entrants. This is so because the rents that established firms earn from producing output are systematically higher or, if you will, the losses from

being excluded are systematically greater. Consequently, existing firms will bid more to defeat the regulation. From the point of view of A, however, an increased market supply resulting from new entry is just as harmful as increases in output of existing firms. As a result, precluding production by new entrants is a "better buy" than constraining existing firms.

Efficient cost minimization must also balance A's gains from the regulation against the losses suffered by B, because those losses will translate into greater costs for A in the form of a higher price required to bid successfully for the introduction of the regulation. Of course, the extent to which B's losses must be taken into account depends quite crucially on the exact political and institutional structure of the regulatory marketplace.

In any analysis of "bidding" by coalition members, free rider problems must be examined. Consumers, producers who gain from the regulation and producers who are harmed by the regulation all confront potential free rider problems in seeking to influence the regulatory outcome. The relative magnitudes of these free rider difficulties obviously vary from case to case. In some circumstances at least, the difficulties of consumers organizing are so great that regulation benefiting producers can be enacted even when the consumers' loss exceeds the producers'

gains. This is the standard case studied as rent-seeking.[1] As among producer groups, the relative efficacy of the contesting groups in organizing to exercise political influence may also vary.

These free rider problems predict that, in practice, a group might be willing to pay less than its "true" value of obtaining or defeating the regulation. The more serious the free rider problem the more likely the amount which can be brought to bear in influencing the outcome will fall below the value of obtaining or defeating the regulation.

In the analysis that follows, we make the extreme assumption that prohibitive transactions costs prevent consumers from participating at all in the regulatory process. At the other extreme, we assume the various producer groups face no free rider problems at all and are each willing to "bid" up to the total benefits (or losses) to the group.[2] Although these assumptions represent limiting cases and serve to restrict the applicability of our formal results, they allow us to focus on the role of relative stakes of producer groups in effecting rent-seeking special interest regulations.

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[1] The "capture" theorists give consumers a more active role. See Stigler (1971) and Peltzman (1976).

[2] Alternatively, our results also hold for the case in which there are no systematic differences in the free rider problems facing A and B, so that each would bid an equal fraction of total gains (or losses). In this case, it would still be true that the winner would be the group with higher net benefit.

We must also consider the "price" that the winning coalition must actually pay for a regulatory change. It is not at all clear that the "price" which will ultimately have to be paid will ever equal the amount that the group, even taking account of free rider difficulties, is prepared to pay. This follows because a group that anticipates defeat in the political arena may choose not to waste its resources waging a futile struggle. If this decision is made, the prevailing side can secure the regulation at a cost well below what it would be prepared to pay. Instead, the "price" actually paid would equal only the cost of making a credible threat to outspend rivals.

Strategic complications also exist on the selling side of the market.[1] One would expect suppliers of regulation to seek to capture a share of the available gains. For example, if there were one monopoly supplier of regulation and one purchaser who stood to gain most from passage of the regulation, there would be a bilateral monopoly and the distribution of the gains produced by the regulation between buyer and seller would depend on strategic considerations. Suppliers might adopt tactics involving precommitment and timing to increase their share of the gains. If, on the other hand, the supply side were in some sense competitive, then more of the gains would be realized by the private firms "purchasing" the regulation. One potential

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[1] For an interesting discussion of some of these issues see Lave and Romer (1982).

supplier might, for example, compete by using sophisticated agenda control measures to win the "competition" against other suppliers. In the analysis that follows, we ignore such strategic complications and assume, instead, an institutional structure in which the suppliers of regulation are fairly passive. This assumption also allows us to focus on the effects on the outcome of the relative stakes of the groups of producers in the industry.

C. Alternative Models of Regulatory Change

We begin by considering a situation in which a legislative or regulatory body is considering a regulatory change. For the time being, we do not consider how the new proposal arose. We focus solely on how the effects of this regulation on groups A and B determine the political outcome. Effects on consumers and producers outside the industry are ignored.

The interaction of free rider problems and the requirement that "bids" are credible must be formalized. The following three alternative postulates are plausible: (1) A regulatory change is implemented only if A gains. (2) A regulatory change is implemented only if A gains more than B loses. (3) A regulatory change is implemented only if both A and B gain. These three postulates do not concern the question of what payments must be made. We discuss that issue in the following section. These three postualtes are "nested" in that each postulate is more restrictive than the preceding one.

Various theories of regulatory change can be constructed by adopting one of these postulates. For example, Postulate 1 assumes that the regulatory authority is completely captured by group A. Under Postulate 2, the regulatory authority responds to the net change in the rents of producers in the industry. This might arise if groups A and B make credible "bids" to effect or thwart a proposed regulatory change and if the regulatory authority acted in respone to the highest "bid." This type of bidding structure could arise in an environment in which A credibly threatens to expected research, lobbying and litigation efforts up to the amount of its total gain from the regulation and B credibly threatens to spend up to its losses to prevent introduction of the regulation. Finally, Postulate 3 assumes that the regulatory authority is unwilling to impose losses on any producer group.

Postulate 2 is perhaps the most interesting because, as we demonstrate below, it implies that a regulation is implemented only if it increases total industry profits. That is, Postulate 2 leads to the special interest, rent seeking result that regulation increases joint industry profits. As we demonstrate below, an even stronger statement of the rent-seeking, special interest hypothesis is obtained under certain limited conditions. These results do not occur because A compensates B for its losses. Indeed, we have not yet discussed the price A must pay to implement the regulation. Instead, the results obtain regardless of how A is able credibly to threaten a higher bid than B. There is

no requirement that any particular price be paid. Moreover, this outcome is <u>not</u> a Pareto-superior allocation. Because A does not compensate B, A is made strictly better off but B is made strictly worse off. Nor must social wealth increase. Losses borne by consumers or producers outside the industry are neither compensated nor even taken into account in the decision calculus set out here. In this case, competition for rents does not lead to efficiency, but to the cartel outcome.

Formally, let $V^A(r)$ and $V^B(r)$ be the change in rents for A and B resulting from a change in regulation to r. Then if $\pi^A(r)$ and $\pi^B(r)$ are the total rents accruing to A and B at regulation level r and the initial level of regulation is $\bar{r}$, we have

$$\begin{aligned} &\text{(i)} \quad V^A(r) = \pi^A(r) - \pi^A(\bar{r}) \\ &\text{(ii)} \quad V^B(r) = \pi^B(r) - \pi^B(\bar{r}) \end{aligned} \tag{16}$$

Thus, Postulate 1 corresponds to a constraint that $V^A > 0$, Postulate 2 to a constraint that $V^A > -V^B$ and Postulate 3 to a pair of constraints $V^A > V^B > 0$. Each postulate leads to a different regulation being adopted.

We now prove a necessary and sufficient condition for a regulation to be adopted when Postulate 2 governs the outcome. Suppose a potential increase in regulation to r increases A's rents (i.e., $V^A(r) > 0$). Then A gains more than B loses from the increase in regulation if and only if

$$V^A(r) + V^B(r) > 0 \tag{17}$$

Substituting equation (16) into (17), the respective changes in profits (V^A, V^B) are equal to the changes in revenues minus the change in costs. Therefore, we have the following result.

Result 7

A necessary and sufficient condition for a regulatory change to satisfy Postulate 2, i.e., group A gains more than group B loses, is that total industry profits rise (i.e., total industry revenues increase more than total industry costs.)

1. Other Necessary and Sufficient Conditions

We will now derive some other necessary and sufficient conditions for group A to gain more than group B loses, building on equation (17) and Results 5 and 6. Starting with Result 5, consider the following two inequalities:

$$\begin{aligned} V^A(r_1)+V^B(r_1) &= p_1(a_1+b_1) - p(a_0+b_0) - [A(a_1,r_1)+B(b_1,r_1)] \\ &\quad + [A(a_0,r_0)+B(b_0,r_0)] \qquad (18) \\ &> p^1(a_0+b_0) + p^1(a_1+b_1) - [(A(a_0,r_1)+B(b_0,r_1)] \\ &\quad + [A(a_0,r_0)+B(b_0,r_0)] \end{aligned}$$

The interpretation of (18) is straightforward. The aggregate change in rents is at least as large as the aggregate change in revenues minus costs calculated for fixed output. This gives us the following result.

Result 8

A sufficient condition for group A to gain more than group B loses is that group A gains and aggregate revenues minus aggregate costs increase where revenues and costs are calculated at pre-regulation output levels for A and B.

Result 8, in principle, would allow calculation of a sufficient condition without complete determination of the effects of increased regulation on the entire range of A's and B's supply curves, as long as the post-regulation equilibrium price could be calculated. Alternatively, the effects of increased regulation on A's and B's costs, assuming fixed output, can be easily calculated. Then Result 8 can be used to calculate what increase in price would be sufficient for the regulation to benefit A more than it hurts B.

In an argument analogous to that just used, we can use Result 6 to derive the following result.

Result 9

A necessary condition for group A to gain more than group B loses is that group A gain and aggregate revenues minus aggregate costs, increase, where revenues and costs are calculated at post-regulation output levels.

As with Result 8, Result 9 is useful because, in principle, it may be possible to estimate the components required for Result 9 without having all the information necessary to estimate demand and supply curves.

D. The Equilibrium Price of Regulation

Up to now we have analyzed the implication of Postulate 2 where A and B are assumed credibly to bid up to their gains or losses and group A is assumed to win if its gain is larger than the losses to B. However, we have not made any assumptions regarding the price A must pay for the regulation. Suppose, for example, that the regulatory body is choosing between two mutually exclusive changes in regulation, r_1 and r_2. Assuming either change is profitable for A, the analysis presented thus far cannot determine which change is implemented. Alternatively, consider a situation in which A controls the agenda, and therefore can itself propose regulatory changes. Again, our previous analysis makes no prediction. What is needed to complete the model is an assumption regarding the price A must actually pay. For example, consider the following choice.

Proposal	Gains to A	Losses to B
r_1	100	80
r_2	90	50

If A does not have to pay any price for the regulation, i.e., if it wins simply by dint of the credible threat of outbidding B, then r_1 is its preferred alternative. However, if A must

actually outbid B by paying more than A's maximum bid of 50, r_2 is A's preferred alternative.

The exact amount A must pay depends on the additional compliance costs the regulation places on B the new equilibrium price, and the particular political and institutional structure governing regulatory change. The strongest rent-seeking, special interest regulation result--that the equilibrium in the regulation market replicates the cartel outcome--obtains under a particular set of institutional postulates as follows. Suppose we postulate a case in which regulations are literally auctioned off in a "second price" auction. That is, A must pay an implementation cost equal to (or slightly above) the full amount of B's losses. If we also postulate that A can choose among all possible alternative regulatory changes, then the strong result obtains. Formally, A's most preferred winning regulatory change is the r that solves the optimization problem[1]

$$\begin{aligned} &\max_{[r]} \; V^A(r) - V^B(r) \\ &\quad \text{subj. to:} \quad V^A(r) \geq V^B(r) \end{aligned} \tag{21}$$

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[1] As an alternative, if group A must credibly outbid group B, but need not actually pay for its adoption, its optimization problem would satisfy Postulate 1 as follows: max V^A, subject to $V^A > V^B$. If Postulate 3 were also necessary, the problem would be max H(r), where $H(r) = \max (V^A, V^B)$, subject to $\min(V^A, V^B) > 0$, where the dominant coalition is the group with the greater gains. Neither of these alternative formulations would lead to the strong rent-seeking, special-interest result of cartelization as an equilibrium.

Substituting from (16), we have

$$V^A(r)-V^B(r) = \Pi^A(r)+\Pi^B(r) - K, \tag{22}$$

where

$$K = \Pi^B(\bar{r})-\Pi^A(\bar{r}), \text{ a constant} \tag{23}$$

Thus, the net return to group A equals total industry profits less a constant determined by the regulatory status quo. This leads to the following sufficient condition for the strong rent-seeking, special interest result.

Result 10

> Group A has an incentive to choose the "cartel" regulation, that is, the proposal that maximizes joint industry profits, if A must pay an implementation cost equal to the losses incurred by B and there are no free-rider problems facing either group A or group B.

This is stronger than our previous result. Result 7 concerned an exogenously given regulatory change. Result 10 states that group A will be successful in implementing the regulation that maximizes industry joint profits. As before, this incentive to adopt cartel regulations does not arise because A must compensate B for its losses. Rather, an amount equal to B's losses are dissipated by A in order to effect the regulatory change.

Finally, we have assumed so far that both groups make credible bids equal to their aggregate benefits or losses. However, this strong result would also obtain if free riding is symmetric between A and B, that is, if both groups are able to garner an exactly equal proportion of total rents vested (or destroyed) to credibly "bid" in the regulation market.[1] It is only in these two cases that the strong result obtains. If the significance of free rider problem is asymmetric, or if group A need not pay for the regulation, an amount in excess of what B would pay to block its introduction the strong result will not obtain. Thus, at least one of these sufficient conditions is also necessary.

D. Credibility in Post-Regulatory Implementation

In the case in which A is a dominant firm, an interesting credibility problem arises as follows. If the dominant firm must outbid the fringe, it will choose a post-regulation price that maximizes the sum of industry profits. This occurs because A chooses a price ex ante which maximizes its own profits, taking into account the amount which must be bid to obtain the regulation. But, ex post, after the regulatory change is implemented and the bidding costs are sunk, A may find it profitable to choose a lower price which permits it to capture a larger share of the market.

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[1] In this case, group A would choose the regulation that maximizes $\lambda(V^A - V^B)$ where λ denotes the common fraction of total benefits "bid" by each group.

Thus, we have a potential ex ante-ex post conflict here, since A's bidding costs depend on B's ex post incremental losses which depend on A's ex post decisions. This conflict obviously resolves itself if A must outbid the fringe each period. Alternatively, the conflict would be eliminated if A were to seek regulatory changes that would ensure the credibility of its ex post actions.

If A could seek regulatory changes that credibly ensure "high" prices ex post, the fringe would benefit, and thus, would reduce the amount it otherwise would bid to defeat the measure by the added revenue it would realize because of the higher industry price. Thus, it can be profitable for A to lock itself into actions that would otherwise not be profitable ex post.

The dominant firm can sometimes establish credibility by making an effective commitment to choose a high price by proposing a regulation that irreversibly increases its own marginal costs as well as the fringe's. For example, a regulation that mandates technological design standards (e.g., smokestack scrubbers) would generally be irreversible. If this regulation also raises group A's marginal production costs, it will serve as a credible commitment. Of course, this committment reduces group A's production efficiency. However, A may gain because it shares

more in the price it pays for the regulation than it looses from adopting the less efficient technology.[1]

In some cases, of course, the dominant firm may achieve credibility by proposing a regulation that mandates direct governmental, price regulation at the joint industry profit-maximizing level. Unfortunately, however, direct price regulation may provide less security to the fringe to the extent that the dominant firm, ex post, would have a strong incentive to circumvent it by concealing price cuts, improving product quality, or not restricting output to the necessary level. If, on the other hand, the dominant frim were forced irreversibly to adopt a technology with high variable costs, it would in its own self interest choose a higher price.[2]

It is true that if firms could easily make enforceable price and production commitments, the costly regulations of the sort analyzed throughout this paper would be unnecessary. Instead, the fringe would simply propose a regulation that requires a dominant firm to set the joint profit-maximizing price and allocates it an appropriate output quota to support that price. This regulation would reduce the dominant firm's profits by less than it would raise the fringe's profit levels. However, unless

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[1] For analogous behavior by an entrant in an unregulated environment, see Gelman and Salop (1983).

[2] Alternatively, of course, if regulation focusing on costs were easier to enforce than regulation focusing on price, the fringe would also prefer the cost based approach.

the fringe and dominant firm can be required, ex post, to reduce their output, this regulation would not be effective. This is the role of efficiency-reducing regulations. By raising the marginal costs of the firms in the industry, a credible commitment to lower output is assured. If marginal costs are increased by more than average costs and demand is not too elastic, this regulatory strategy is profitable.

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