A POSITIVE THEORY OF GOVERNMENT

FIRM REGULATION

by

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I. Introduction

One way to regulate an oligopolistic industry is with a government enterprise. Suppose the government enterprise in the industry announces that it will make up any differences between target industry output and the output of the private firms. Provided the government firm's reaction function is credible, each private firm faces a fixed output price and its profit maximizing decision is to produce where marginal cost equals price. Provided target industry output is set where industry marginal cost equals price, the government enterprise will also produce where its marginal cost equals price.

The purpose of this paper is to develope a theory of the behavior of a government enterprise that competes directly with privately owned firms in an oligopolistic industry. We will model the self-interest interactions of consumers, private producers, politicians, and managers of the government firm.[1] These interactions depend on the incentive structure facing the government firm managers. The fundamental result of the paper is that:

An incentive structure exists which is compatible with the interests of the interacting parties[2] and which will cause the government firm managers to behave as efficient regulators.

Note that we are assuming that the government in question cannot or will not remove the barriers to entry that sustain the rents obtained by the industry. The nature of technology could be such that due to indivisibilities, decreasing costs occur over only some range of output and it is desirable to have more than one firm in the market, but not more than a few firms. The large numbers condition for competitive returns is not satisfied.

An oligopolistic situation may arise with firms colluding or firms engaging in non-competive practices such that output levels are too low.

II. The Model

Parties with an interest in the price that obtains in an oligopolistic industry are consumers of the industry's product, private producers, politicians and managers of the government firm. We make the following simplifying behavioral assumptions. All parties are wealth maximizers. Rent seeking by all parties is a direct implication of wealth maximization. Politicians receive political support from the consumers in the form of votes. Assume that the number of votes (V) cast by consumers in favor of a particular political group[3,4] is a function of the consumer surplus (C) provided by the group:

$$V = V(C), \quad V^1 > 0, \quad V^{11} < 0.$$

Politicians receive support from producers by way of election funds and other indirect benefits. Assume that producer support (T) of a particular political group is a function of the producer surplus (S) provided by the group:

$$T = T(S), \quad T^1 > 0, \quad T^{11} < 0.$$

A politicians wealth (W) is a function of the number of votes cast in his favor and producers support:

$$W = W(V, T) \quad \text{where } W_V > 0, \quad W_T > 0.$$

A political group can influence the distribution between producer

surplus and consumer surplus by varying the incentive structure of the
managers of the government firm. Consider the following incentive scheme
where the management group's income (I) is a function of profits plus a
percentage of the value of industry output:

$$I(Q) = D(Q)q_o - C_o(q_o) + \beta(D(Q) \cdot Q)^5 \qquad (2.1)$$

where

> Q = industry output,
>
> $D(Q)$ = industry's inverse demand schedule,
>
> q_o = government firm's output,
>
> C_o = government firm's cost schedule,
>
> β = fraction of the value of industry output obtained
> by the managers.

Private firms maximize profits given by

$$\pi_i = D(Q) \cdot q_i - C_i(q_i), \quad i = 1, \cdots, n \qquad (2.2)$$

where q_i and C_i are respectively the ith firm's output and cost function
and n = the number of private firms in the industry.

The politicians can influence the events in the industry (and their
wealth) by varying the parameter β. To demonstrate this proposition
suppose the government firm is the dominant firm and the reaction function
described in the introduction is credible. Since all private firms are
assumed to be price takers given the government firm's reaction function,
they will set output levels so that price = marginal cost,

$$D(Q) = C_i^1(q_i), \quad i = 1, \cdots, n,$$

where Q is target industry output. These equations can be solved for q_i as
a function of Q,

$$q_i = f_i(Q), \quad i = 1, \ldots, n$$

where $f_i^1 < 0$.

The objective function of the management group of the government firm can be written as

$$I(Q) = f_o(Q)D(Q) - C_o(f_o(Q)) + \beta(Q \cdot D(Q)),$$

where

$$f_o(Q) = Q - f(Q),$$

$$f(Q) = \sum_{i=1}^{n} f_i(Q).$$

The income maximizing target output is computed by solving the following yielding Q*:

$$\frac{dI}{dQ} = f_o^1(Q)D(Q) + f_o(Q) D^1(Q) - C_o^1(f_o(Q)) f_o^1(Q)$$

$$+ \beta[D(Q) + QD^1(Q)] = 0.$$

The optimal target output is illustrated in the following diagram:

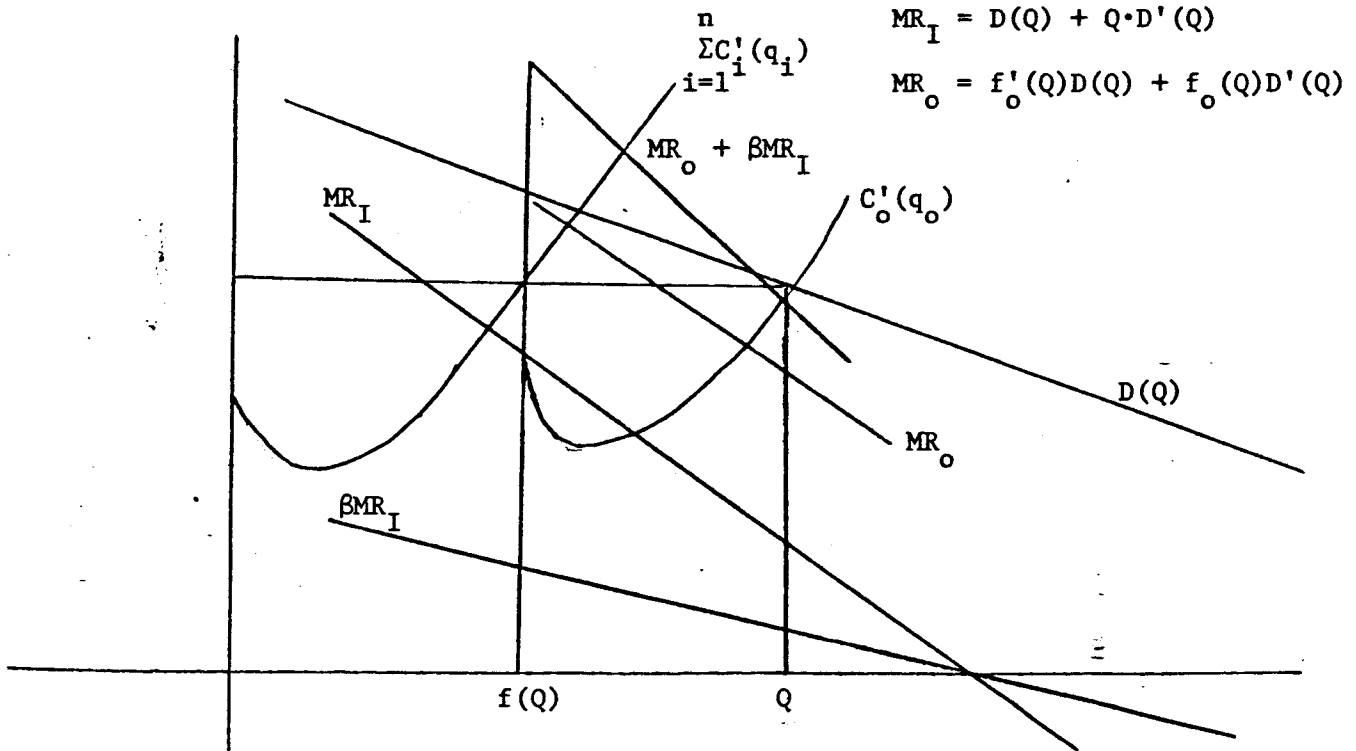$$MR_I = D(Q) + Q \cdot D'(Q)$$

$$MR_o = f_o'(Q)D(Q) + f_o(Q)D'(Q)$$

DIAGRAM I

Under reasonable conditions, target industry output is an increasing function of β. Consequently, consumer surplus is an increasing function of target output and thereby of β:

$$C = C(\beta), \quad C^1 > 0.$$

Private producer surplus is a decreasing function of β:

$$S = S(\beta), \quad S^1 < 0.$$

Combining the above we get:

$$V = V(C(\beta)),$$

$$T = T(S(\beta)),$$

$$\frac{dV}{d\beta} = V^1 \cdot C^1 > 0,$$

$$\frac{dT}{d\beta} = T^1 \cdot S^1 < 0.$$

Politicians will select β so as to maximize

$$W = W(V(C(\beta)), T(S(\beta))),$$

a concave function in β given the above assumptions and therefore a determinate β exists.

Note also that if the managers income and private firms' profit equations are written in terms of inputs, input prices, and technology then we can also show that the government firm managers will use a cost minimizing combination of inputs.[6]

If the government firm is the dominant firm in the industry, then an incentive scheme exists which is compatible with the interests of the politicians and which will cause the government firm managers to behave as efficient regulators.

III. Elaborations and Extensions

In this section we elaborate and extend the fundamental result of
Section II.

a. Under what conditions will the private firms behave as price-takers?

The reaction function of the government firm is effective only if it
is credible. Credibility of the threat will depend on the impact that
calling the threat will have on the wealth of the parties involved. If
the private firms decide to restrict output, the government firm would have
to produce at a level where its marginal cost of output exceeds price to meet
target output.

The cost to the government firm managers of the private firms calling
the threat is an increasing function of both the restriction in output and
the elasticity of the government firm's cost schedule. If the interval
of time under consideration is sufficiently long, the government firm could
acquire additional plant capacity and the appropriate cost concept is the
long-run cost schedule. This aspect of the problem requires an explicit
dynamic framework which takes the strategic intertemporal interaction of
the government and private firms into account.

Deviations from what the politicians regard as the optimal industry
output has an impact on their wealth. The politicians can offset the
restriction in output by the private firms by increasing β. Thus the
credibility of the government firm's strategy depends on the financial
backing of the government. Alternatively, when government firm regulation
commences β could initially be set relatively high until the industry
gradually settles into a strategic equilibrium[7] when optimal β from the
politicians point of view could be reduced.

If the target industry output is set so that the private firms still earn some rents, the private firms are less likely to challenge the government firm's declared strategy.[8]

b. **If the private firms do not behave as price-takers what can be said about the industry's strategic equilibrium?**

This would result in an n-player game where the payoffs (ignoring side-payments) are given by equation (2.1) and (2.2). A Cournot equilibrium with one private firm and one government firm is illustrated in Diagram II. The equilibrium would also be a strategic equilibrium if the shadow cost exceeds the shadow value from the point of view of both firms of attempting to change either its strategy and/or the strategy of the other firm.

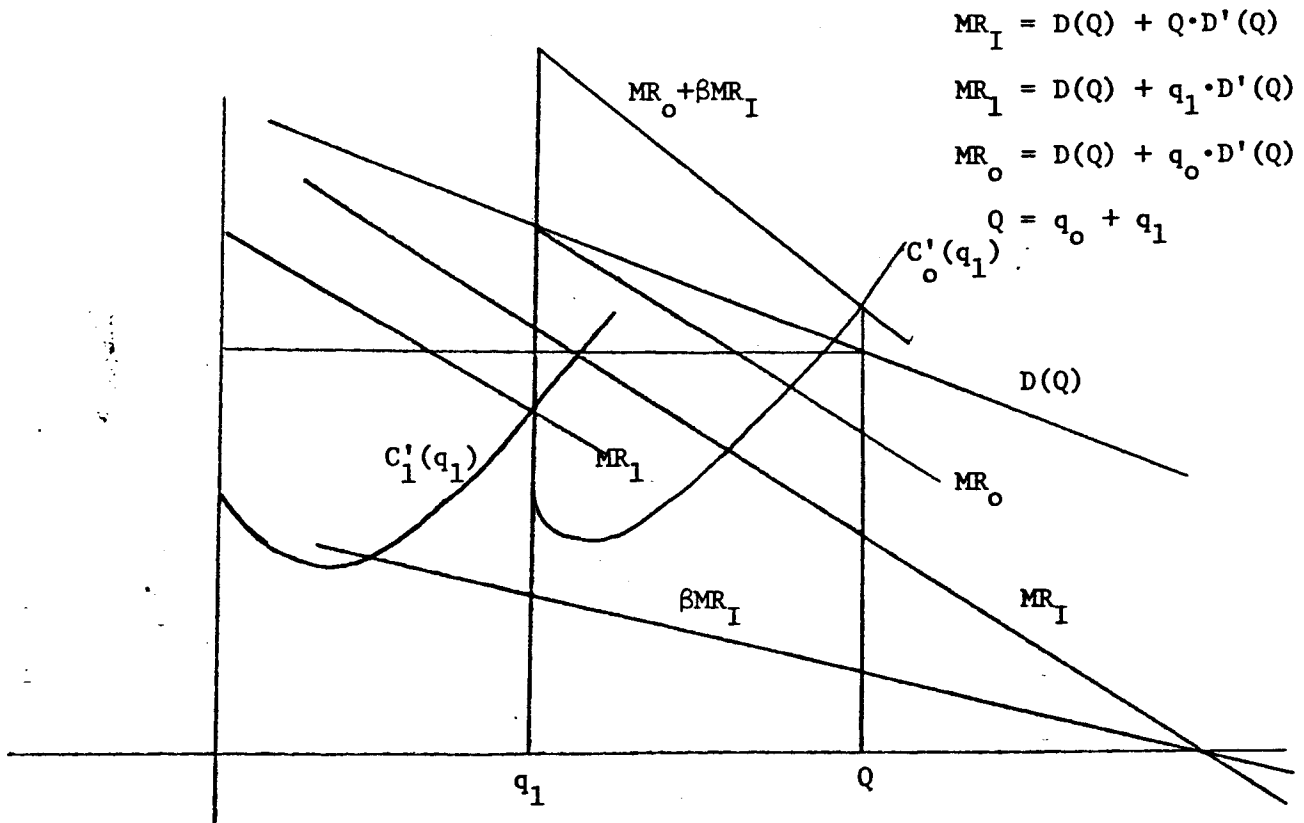Under reasonable conditions, industry output will be an increasing function of β.

$$MR_I = D(Q) + Q \cdot D'(Q)$$

$$MR_1 = D(Q) + q_1 \cdot D'(Q)$$

$$MR_0 = D(Q) + q_0 \cdot D'(Q)$$

$$Q = q_0 + q_1$$

DIAGRAM II

c. **Will all firms be covering total costs at the price determined by target output?**

The above analysis assumed the industry consisted of a fixed number of firms, such that in an allocation with all firms having price equal to marginal cost, no firms incur a loss. These results also hold in the situation where firms have fixed costs or increasing returns and where the number of firms in the industry is taken as endogenous. Here, the politicians must estimate the effect that each price would have on entry and/or exit, and consumer and producer surplus in computing their wealth maximizing β. From the politicians (consumers and remaining private firms) point of view it might be desirable to reduce the number of firms that exist in the industry.

d. **If a private firm is not covering its variable costs and decides to go out of business does it "profit" the government firm managers to purchase the defunct firm's capital stock?**

The answer to this question depends on the circumstances that drove the private firm out of business. One strategy of the government firm might be to use "price-cutting tactics" as a means of obtaining capital stock. Alternatively, the government firm could operate some plants at a loss given the subsidy it receives via β.

e. **Is there a determinate size of the government firm for a given value of β?**

We already have the result that the government firm will use the least-

cost combination of inputs (including capital) for each level of output. The strategic importance of government firm's capital stock was mentioned in a. above. Wiens and Harris [1977] have shown that a reaction function exists in terms of investment levels such that the dominant strategy for any private firm is to choose the socially desirable capacity expansion plan. Similar intertemporal results will hold with the managerial incentive scheme introduced above.

If average costs are constant over the range of the market, it may be necessary for the politicians to place a constraint on g.f. capital stock to prevent the g. f. from taking over the entire industry.

f. What is the source of information on demand and cost schedules required by the politicians and g.f. managers?

Suppose the state believes that rents exist in a particular industry and decides to intervene by purchasing an existing firm or creating a new firm. If the state purchases a firm previously privately owned it will immediately acquire information on cost and demand conditions in the industry. In either case it will obtain valuable information in the day-to-day operation of its firm.

The government can then extrapolate this information to the entire industry. The accuracy of this extrapolation depends on the correlation between the government firm's and the private firms' cost schedules. Since a substantial subset of the relevant factor prices are the same for all firms in any industry and given equal access to technology, one would expect that the degree of correlation is quite high. The principal source of variance between cost schedules would be location or firm specific advantages and technologies. At any rate the politicians can use information

about g.f. cost and demand conditions to estimate industry demand and cost
schedules and compute the wealth maximizing level of β.

Once the politicians have set β, the g.f. would automatically respond to
changes in demand and cost conditions. Thus the g.f. would behave as a
decentralized regulatory agency.

g. <u>Are there incentives for g.f. managers to misrepresent information
to politicians?</u>

The value of β determines the share of g.f. managers' income received via
the regulatory subsidy. It does not determine the absolute level of their
income. Information about the value of industry output need not be obtained by
politicians from the government firm. Government firm managers obtain the residual
of the g.f. plus the regulatory incentive. They could choose to take part
of their income before corporate income taxes at the price of reducing the resid-
ual. Competition for the g.f. manager position would ensure a normal rate of
return to such practices.

h. <u>Why doesn't the government just nationalize the industry?</u>

If politicians nationalize the industry they lose the private producers
as a source of wealth. Furthermore, the industry cost schedule would shift
upward if the optimal number of firms in the industry is greater than one.
Nationalizing the industry, from the politicians point of view, is a
corner solution.

i. <u>What is the source of revenue for the β(value of industry output)
component of g.f. managers' income?</u>

The increase in consumer surplus resulting from the operations of the
government firm managers translates to an increase in consumer's real
income. An incentive compatible policy rule is to tax the benefactors of
the program, namely the consumers.

j. <u>How would the managerial incentive function be specified in practice?</u>

The board of directors of a firm are responsible for setting incentives
for managers. Politicians could be represented on the board of directors

of the g.f. by senior civil servants. The regulatory incentive (value of β)
could be reviewed periodically and changes in its value would depend on
shifts in demand and cost conditions as perceived by the politicians and/or
their representatives.

k. Why not just pay a private firm to act as a regulator?

In effect the g.f. managers become the residual claimants of income
accruing to the government firm. Competition for the job of government
firm manager would ensure that individuals with a comparative advantage
as government firm regulators obtain the job. The absolute level of their
income would be influenced by the natural job alternatives of government
firm managers. Some alternatives are managing other government firms,
managing private firms, and/or becoming a politician.

If the government pays a private firm to act as a regulator based on
the above incentive scheme, the shareholders of the private firm become
the residual claimant of regulation. If this was practicable, the be-
havioral implications of the incentive scheme are the same. The possibility
of reapportionment of ownership can be compared with the possibility of
changing the government firm manager.

Government firm ownership may have an advantage from the politicians
point of view for two reasons. First, the effectiveness of government
firm regulation is based on threat--the government firm managers with
the financial backing of the government may have a more credible threat.
If the threat is credible, the threat will not be called.

Second, a contractual relationship with a private firm to provide
regulatory services may involve greater transaction costs. Thus the poli-
ticians may chose to integrate into the regulatory agency. (See point j.)

l. What incentives are there for collusion between private firms
and g.f. managers?

Private firms could offset the regulatory incentive β where β>0, for
example by a counter incentive δ·(value of industry output) where δ<0.

If $\beta + \delta < 0$, the government firm would behave like a cartelizing agent rather than a regulating agent. Politicians have an incentive to police such exchanges. First, they stand to lose some producer support. Second, the resulting decrease in consumer surplus would mean a loss of votes. Less risky, but perhaps more costly (smaller variance, lower mean return), from the private producer's point of view would be to increase political support for a political group guaranting low and perhaps negative β values.

m. What are the advantages of g.f. regulation over other types of regulation[9]

This question is considered in detail in Harris and Wiens [1977] and Wiens [1978].[10] Price regulators must obtain cost and demand information from the private firms and they obtain this information with a lag. Government firms managers obtain this information in their day-to-day activities and can respond more quickly to changes in these conditions. Antitrust legislation is not very effective in dealing with tacit or implicit collusion and its limitations are well known. Tax-subsidy solutions have information problems and will not result in an efficient allocation of resources in an oligopoly industry when firms game theoretically respond to these instruments. Finally, no one has yet devised an incentive scheme to get the controllers of these policy devices to behave as efficient regulators.

n. What role can a government firm play in an industry characterized by a few firms producing products which are close substitutes or complements?

A government firm can also be used to regulate a monopolistically competitive industry. If the government firm can shift each private firm's demand function through changes in the price of its product, a reaction function exists which will enforce a desired allocation of output across firms. The government firm may be unable to back up its threat if more than one firm decides to call its threat. It could, however, increase the number of goods it produces and thereby increase the potency of its threat.

IV. Conclusions

Suppose that wealth maximizing, politicians suspect that producers in an oligopolistic industry are earning rents. To obtain support from the producers and votes from the consumers the politicians create or threaten to create[11] a government firm to compete directly with the private producers. In either case the government firm can be used as a threat to increase output and to lower price and to obtain support from both producers and voters. We have introduced an incentive scheme which is compatible with the interests of the interacting parties (politicians, consumers, private producers, and government firm managers) and which will cause the g.f. managers to behave as efficient regulators.

FOOTNOTES

1. The paper considers government firm regulation along the lines of Stigler [1971], Peltzman [1971, 1976], Hirshleifer [1976], and Becker [1976].

2. The shadow cost exceeds the shadow value from the point of view of the party (and/or parties) of the first part of changing its strategy and/or of attempting to change the strategy of the party (and/or parties) of the second part.

3. We are not concerned here with the problems of the determination of political groups or their optimal size but assume the political coalitions are predetermined. Peltzman [1976] has done some work on this problem.

4. We are dealing in partial equilibrium analysis. Clearly politicians make many decisions which have an impact on the real income of consumers and on votes cast in their favor.

5. Equation (2.1) determines the relative benefits to the management group of profits versus industry output. Their absolute level of income could be a fraction or multiple of I. Since max $\alpha I = \alpha$ max I we ignore the α term in the paper.

6. The incentive scheme introduced in this paper is also effective in the situation of a government monopoly. Consider the management incentive scheme:
$$I(Q) = D(Q) \cdot Q - C(Q) + \beta(D(Q) \cdot Q),$$
$$\frac{dI}{dQ} = (1 + \beta) (D + Q \cdot D^1) - C^1 = 0.$$

    Under reasonable conditions a β exists such that managers will cost minimize and set Q^* so that
$$D(Q^*) = C^1(Q^*).$$

7. See footnote 2.

8. There is no point threatening a firm that is earning "normal profits". To obtain producer support via the threat of increased output by the government firm, the private firms must be earning some rents which they don't want to lose.

9. As Peltzman [1971] points out, government enterprise and effective regulation or taxation are substitutes.

10. Wiens [1978] compares government firm regulation with antitrust and
    vertical divestiture in the situation of public intervention in a
    vertically integrated industry. Government firm regulation is found
    to be superior because it does not place constraints on asset market
    transactions. Market power and rents which may result from increased
    concentration (only a small number of firms can take advantage of cost
    reductions that result from vertical integration given the size of the
    market) are offset by direct competition from the government firm.

11. The literature on pricing to forestall entry applies. Here the private
    producers might lower the output price to forestall entry by the
    government firm.

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