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The *Babu* and the *Boxwallah*: Managerial Incentives and Government Intervention in a Developing Economy

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Abstract

In developing economies a firm's strategy is directed more often at the government than at other competing firms. As an initial step towards modeling such interactions this paper considers a situation where a government confronts a monopoly. The latter chooses price and maximizes profit and the former chooses a tax rate and maximizes tax revenue. The government and the monopoly can delegate the final decision-making to, respectively, a bureaucrat and a manager. The incentive equilibrium of the model is characterized. It is shown that this kind of industrial setting is likely to exhibit greater inefficiencies than that which arises in standard models.

1. Introduction

Standard models of industrial organization are typically based on the experience and institutional set-up of the industrialized nations. Hence there are certain features and issues typical to a less developed economy which these models cannot address adequately. For instance, the standard models of oligopoly investigate the issues of interfirm strategic interaction, not paying any attention to the fact that the crucial strategic thinking that goes on in the industries of many less developed countries and transitional economies is not so much between firms as between the firms and the government. Similarly, there are sophisticated models of entry-deterrence where firms use limit pricing, excess capacity or capital precommitments as instruments to deter potential entrants. But to the incumbent firms of many developing nations the most important instrument to deter entry is tactical lobbying to influence critical government policy and decisions. Thus unless we study government mediation as another strategy of entry deterrence, our understanding of the industrial organization of the developing nations remains incomplete.

All this suggests that there is a strong case for constructing industrial organization models *for* developing nations. In this paper we make an initial attempt in this direction by looking deeper into the issue of government–firm interaction of the kind that one encounters in developing mixed economies.

In the light of the experience of many Third World countries and the recent liber-

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alization effort in socialist economies, it is now recognized that in large parts of the world a firm's strategic decisions are a response not as much to what other firms are doing as to what the government or the bureaucrat is doing. It is being recognized that a government should be treated as another player of the game who may have a different objective function from profit, but in strategic terms is no different from other agents. This is especially true when these agents are large and are endowed with considerable economic power, as would be the case with, for example, monopoly houses or multinational corporations. In Third World countries there are several instances where a multinational firm matches up well with the government of its host country in terms of economic power. This realization has led to a growing literature on government–firm strategic interactions (De Fraja and Delbono, 1989; Anant et al., 1995; Heywood and Pal, 1996). The present paper addresses a specific issue within this broad area.

Following Vickers (1984), Fershtman and Judd (1987), and Sklivas (1987), we begin by recognizing that principal–agent models acquire a new rationale in the presence of strategic interactions. A firm's owner may have an incentive in appointing a manager whose objective function is distinct from the firm's profit. The firm's profit can be shown to increase through such a delegation of authority.

Now consider a set-up where the government is the agent that has the right to decide what the indirect taxes imposed on a firm's product will be. The government's aim is to maximize tax-revenue collection.[1] In pursuing this objective the government can either choose the indirect tax rate itself or can appoint a bureaucrat—or the *babu*, as he is sometimes called in India—giving him suitable incentives. For simplicity, we assume that the tax rate in question is an *ad valorem* tax rate (all the qualititative results go through with per-unit tax). The incentive that the government or the minister gives to the bureaucrat may be financial or nonfinancial. In recent times both Singapore and Hong Kong have followed an incentive wage policy for public officials. Current reforms in tax enforcement in many countries include a bonus to the tax officer based on the amount of tax he or she collects (Bardhan, 1996). For nonfinancial incentives we can refer to the practice in India where incentives are typically administered by giving threats to transfer a person to a less attractive "posting" or promising a promotion if the bureaucrat performs in accord with the minister's wishes.

Confronting this situation is a firm that has to choose the producer price (on which the *ad valorem* tax is levied). The firm's (or, more precisely, its owner's) aim is to maximize profit. But the owner is free to appoint a manager—or a *boxwallah*, as he is at times called in India—and give him a suitable incentive.

What incentives will be given? What will be the price and quantity produced? The aim of this paper is to characterize the subgame perfect equilibrium of this model and then to answer these questions. We show that the ability to delegate decisions heightens the inefficiencies that arise from a monopoly. An interesting corollary that comes out from this analysis is that bureaucrats desiring to promote output are given disincentives while those willing to curb production are rewarded.

Section 2 describes the basic or the benchmark model. Section 3 presents the main model of this paper. It considers the case where government is a monolithic organization while the firm has two tiers—the owner and the manager. We then go on to model the case where government also has two levels—the ministry and the bureaucracy—as described above. Section 5 concludes the paper by discussing possible extensions and alternative frameworks for analyzing the problem and comparing the results with the related literature.

2. The Benchmark Model

We are concerned with an industry where the demand function is

$$q = a - bp, \tag{1}$$

where q is quantity, p price and a and b are positive constants. A single firm confronts this demand function. Its total cost function is

$$C = cq, \quad c > 0. \tag{2}$$

The government chooses an *ad valorem* tax rate, t, whereas the firm chooses the producer price p. Given such a pair of choices, the firm's profit (π) and government's total tax-revenue collection (R) are given by, respectively:

$$\pi(p, t) = (p - c)(a - bp(1 + t)), \tag{3}$$

$$R(p, t) = tp(a - bp(1 + t)). \tag{4}$$

In this section we assume that both the government and the firm are monolithic organizations (i.e., there is no delegation in either of the two) and government chooses t in order to maximize R and the owner of the firm chooses p to maximize π.

The owner's reaction function is derived from $\partial\pi/\partial p = 0$. This gives

$$(p - c/2)(1 + t) = a/2b. \tag{5}$$

The government's reaction function is given by $\partial R/\partial t = 0$, and is

$$p(t + 1/2) = a/2b. \tag{6}$$

This is exactly the case considered in Anant et al. (1995), though they work under greater generality and proceed in a different direction.

Reaction functions (5) and (6) are depicted in a self-explanatory diagram in Figure 1, which also shows two representative iso-profit curves of the owner (ABC and DEF) and two iso-tax-revenue curves of government (UVW and XYZ).

N depicts the Nash equilibrium. Let the values of p and t at N be p^N and t^N. At the Nash equilibrium p^N, $t^N > 0$ as long as $c < a/b$. Since the latter is a natural viability condition, we shall assume that p^N and t^N are indeed positive. As is evident from Anant et al. (1995), this Nash equilibrium is inefficient compared with the simple monopoly equilibrium. In the next two sections we show how this inefficiency is aggravated in the presence of the ability to delegate decisions on the part of both the firm and the government.

3. Equilibrium Managerial Incentives

Let us now think of government as in the benchmark model—a monolithic organization that chooses t in order to maximize R. As far as the firm is concerned, the owner wants to maximize π, and he can, if he so wishes, do so by appointing a manager and leaving it to the manager to choose p. The owner, it will be assumed, can choose any α and set the manager's incentive to be as follows:

$$\begin{aligned} I(\alpha, p, t) &= \alpha\,\text{Profit} + (1 - \alpha)\text{Sales} \\ &= \alpha(p - c)(a - bp(1 + t)) + (1 - \alpha)p(a - bp(1 + t)) \\ &= (a - bp(1 + t))(p - \alpha c). \end{aligned} \tag{7}$$

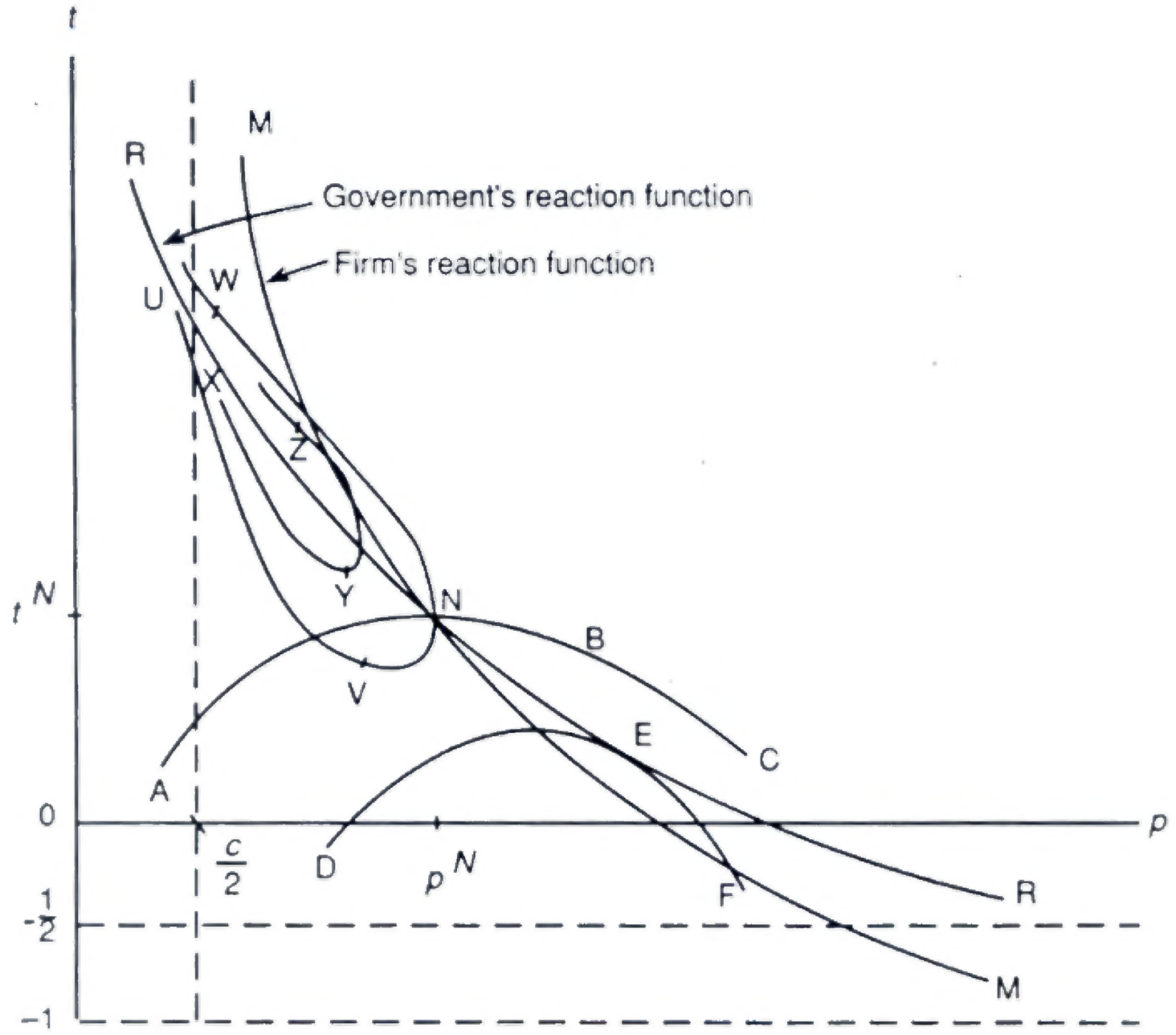

Figure 1. Government versus Firm in the Market Place

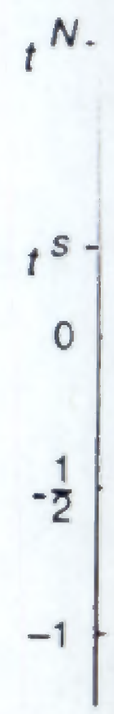

Figure 2. Del

In other words, the owner chooses an α and tells the manager that his or her salary is a positive monotone transform of I. Thus the manager's aim is to maximize I. We are here following Sklivas (1987) and Fershtman and Judd (1987) in restricting the *class* of possible incentives, from which the owner chooses one, to be given by (7) with α free to be set at any level. In other words, the decision whether to have a manager at all is not being modeled (this is done in Basu, 1995) but assuming that the manager is already there, we model the manager's incentive structure.

We now consider the two-stage game where the owner chooses α in period 1 and in period 2 the manager and government simultaneously choose, respectively, p and t. To find the subgame perfect equilibrium of this game, let us see how the manager will behave, with α given.

Clearly the manager sets $\partial I/\partial p = 0$. In other words, the reaction function is

$$\left(P - \alpha c/2\right)\left(1+t\right) = a/2b. \tag{8}$$

Comparing this with (5) it is clear that the manager's reaction function will be to the left of the owner's reaction function if and only if $\alpha < 1$. Since the government is treated as a monolith in this section, its reaction function continues to be given by (6).

In period 2 the Nash equilibrium is given by the values of p and t which solve (6) and (8). It is now easy to see that the firm's owner can therefore choose essentially any point on line RR in Figure 2 by suitably choosing α in period 1. Hence, as in the

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Hence, by (6):

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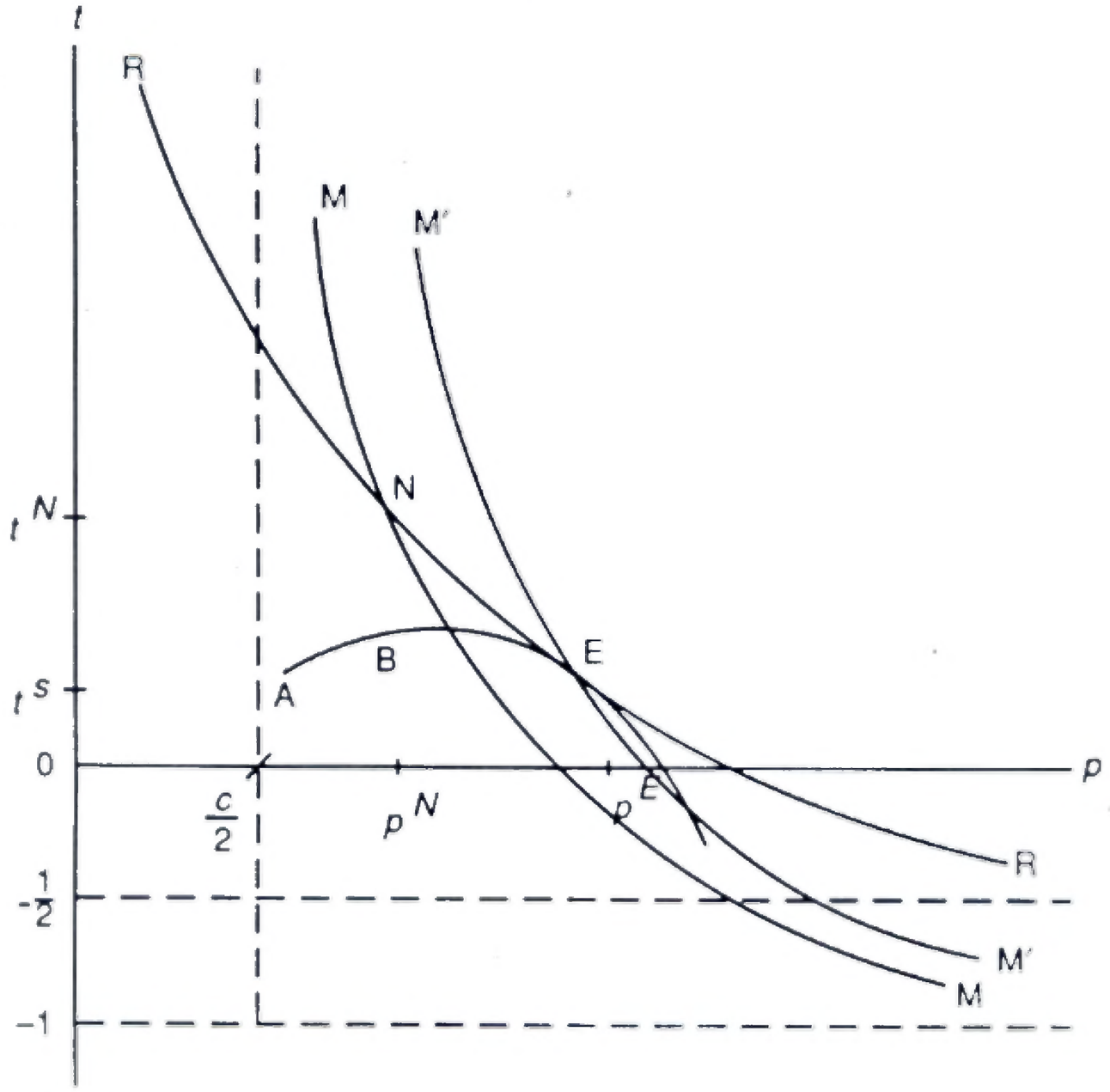

Figure 2. Delegation and Inefficiency in the Presence of Government

Fershtman–Judd model (Basu, 1993), we are headed towards a Stackelberg type solution with the firm as leader. In Figure 2 this happens at E, where ABE is the owner's iso-profit curve.

Formally the equilibrium may be described as follows. Let $p(\alpha)$ and $t(\alpha)$ be the solution of (6) and (8). Then (p^E,t^E,α^E) is an *equilibrium* if

$$\alpha^E = \underset{\alpha}{\operatorname{argmax}}\, \pi\big(p(\alpha), t(\alpha)\big)$$

with $p^E = p(\alpha^E)$ and $t^E = t(\alpha^E)$. The following results are easy to derive. In *equilibrium*,

(a) $\alpha^E > 1$,
(b) $p^E > p^N$,
(c) $t^E < t^N$,
(d) $p^E(1 + t^E) > p^N(1 + t^N)$.

All claims in the above paragraph are obvious from Figure 2 excepting that $p^E(1 + t^E)$ (i.e., the consumer price in equilibrium) exceeds $p^N(1 + t^N)$ (the consumer price at N). To see this, note that, for all p and t,

$$p\big(1+t\big) = p\Big(t + 1/2\Big)\Big) + p/2.$$

Hence, by (6):

$$p^E\big(1+t^E\big) = a/2b + p^E/2.$$

And again, by (6):

$$p^N\left(1+t^N\right)=a/2b+p^N/2.$$

Since $p^E > p^N$, it follows that $p^E(1 + t^E) > p^N(1 + t^N)$.

From (d) it follows that production is even less than that at N. It was shown in Anant et al. (1995) that at N the inefficiency is greater than in a usual monopoly equilibrium. Hence we have established our first proposition that once a firm is free to hire a manager as a strategic instrument against government the inefficiency becomes even more pronounced.

This proposition is interesting in that it enhances our understanding of the widely (and quite often loosely) discussed inefficiency of the industrial structure of Third World countries in the overwhelming presence of governace. The owner exploits the strategic nature of the firm's interaction with government and chooses an incentive scheme for the manager that gives the maximum profit (notice that at E the owner's profit is higher than at N). Since the tax is on sales (or on output in the case of a per-unit tax), it is understandable why the owner discourages sales and hence $\alpha^E > 1$. As the owner shifts the incentive away from sales we end up with an inefficient equilibrium.

4. Delegation within Government

In sections 2 and 3 we have portrayed government as a monolithic organization. In reality the bureaucrats play a crucial and distinct role from the one played by government or the ministers. So it may be worthwhile, following Vickers (1984), Fershtman and Judd (1987) and Sklivas (1987), to take our analysis a step further and allow the government also to delegate decisions to the bureaucrat in order to gain strategic advantages over the firm.

In the earlier sections we modeled government as taking the final decisions. In reality, however, the government or the cabinet only gives a broad outline of the objectives to be pursued, while decision-making at the micro level is delegated to bureaucrats. In the context of Chalmers Johnson's work on the institutional arrangements common to the East Asian countries, Wade (1990, p. 26) observes:

> While state bureacrats "rule", politicians "reign". Their function is not to make policy but to create space for the bureaucracy to maneuver in while also acting as a "safety valve" by forcing the bureaucrats to respond to the needs of groups upon which the stability of the system rests.

Keeping in line with the above idea suppose, as an illustrative exercise, that the government's objective is to maximize $R(p,t)$ as given by (4), but the government delegates the choice of t to the bureaucrat, setting the bureaucrat's incentive to be related to the sales of the industry as follows:

$$\begin{aligned} B\left(\beta,p,t\right) &= \beta\,\text{Tax-revenue} + \left(1-\beta\right)\text{Sales} \\ &= \beta tp\left(a-bp\left(1+t\right)\right)+\left(1-\beta\right)p\left(a-bp\left(1+t\right)\right). \end{aligned} \tag{9}$$

We have the following arguments to motivate the above incentive structure for the bureaucrat.

First, we have modeled the government as maximizing tax-revenue collection. But, understandably, it has to take care of the interests of various pressure groups (the monopoly house in the model). We try to capture this idea by introducing the firm's sales as an argument in the bureaucrat's payoff function.

Second, for reasons of simplicity we delegate the choice of t to the bureaucrat. Reality is of course much more complicated; however, what is important is that bureaucrats do play a significant role in the determination of tax rates. This is quite evident from Wade's (1990, p. 204) description of decision-making in Taiwan:

> Consider the procedures for revising industrial tariffs. Formal authority for tariffs rest with the Ministry of Finance because of the importance of tariffs for government revenue. But Industrial Development Bureau (IDB) is responsible for drawing up the preliminary list of revisions. This may often require hard bargaining intramurally between, say, engineers of the Daily Necessities Division, who cover textiles, and those of the Metal Machinery Division, who cover textile machinery, the former wanting lower tariffs on textile machinery, the latter wanting higher ones. Once the preliminary list is drawn up within IDB, it goes to a special tariff commission comprised of high-level officials of other affected ministries plus the Council for Economic Planning and Development (CEPD), chaired by a vice-minister of finance. In general, the Ministry of Finance is cautious about lowering tariffs in order to protect government revenue. . . . The list which emerges from the negotiations of this commission goes to the Cabinet, which passes it to CEPD for final scrutiny.

Third, it may seem at first that in most countries bureaucrats have salaries which are pretty much fixed; and so the assumption of incentives rising and falling in tune with (9) may, at first sight, seem unreal. However, a moment's thought reveals that even if salaries cannot be changed, ministers can reward and punish bureaucrats through other means. In India, promotion or transfer to a good "posting" is very frequently used by the ministers to reward bureaucrats. And, likewise, blocking promotion and transfers to unattractive jobs are used as punishment. The significance of an attractive "posting" as a credible incentive can be appreciated if we consider Wade's (1985) case study in South India—an Executive Engineer in charge of irrigation may pay as a bribe up to 14 times his annual salary in order to obtain a two-year tenure at a particular location. Instances of financial incentives also are not uncommon. As already mentioned in the introduction, in recent years both Singapore and Hong Kong have followed an incentive wage policy for public officials with a great deal of success (Bardhan, 1996). Current reforms in tax enforcement in the CIAT countries include a bonus to the tax officer based on the amount of taxes he collects (Mookherjee, 1995). What we are assuming is that the net bundle of such incentives (financial and nonfinancial) is positively related to $B(\beta,p,t)$ given by (9). To be more specific, $\beta < 1$ implies that government wishes to promote sales and the bureaucrats doing so will be promoted; on the other hand, if $\beta > 1$ then the bureaucrats striving for increasing sales will be transferred to worse postings. It is interesting to check what value β takes in equilibrium.

Despite the simplicity of our model we believe that a bureaucrat's objective in the complex institutional set-up of developing countries is likely to be much more complicated and accommodating a multiplicity of aspirations. Hence, the model of this section is best viewed as an illustration of the *method* of principal–agent formulations of government policy in the industrial marketplace.

The game we are considering is as follows. In period 1 the owner chooses α and government chooses β. In period 2, the *boxwallah* chooses p and the *babu* chooses t. The equilibrium we want to characterize is subgame perfection. The formal definition of this is obvious and therefore omitted here.

In period 2, the bureaucrat's reaction function is implicitly given by setting $\partial B/\partial t$ equal to zero. By doing so we get

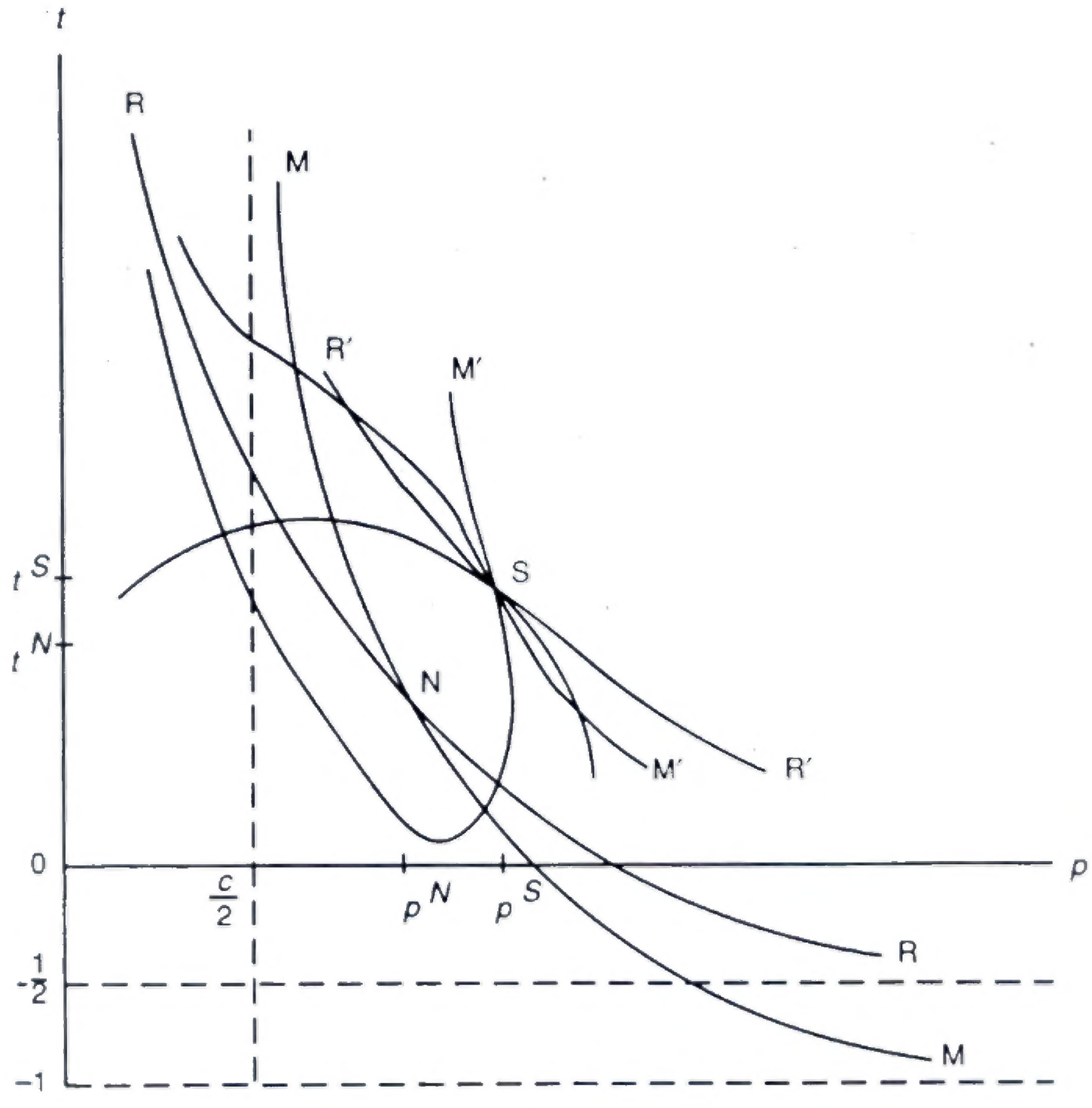

Figure 3. Inefficiency in a Mixed Economy

$$\left(t + 1/2\beta\right)p = a/2b. \tag{10}$$

Comparing this with (6) it is clear that the bureaucrat's reaction function will be to the left of the government's reaction function if and only if $\beta < 1$.

Given (α,β), the equilibrium in period 2 is derived by solving (8) and (10). Let the solution be denoted by $p^*(\alpha,\beta)$ and $t^*(\alpha,\beta)$. The equilibrium values of α and β are then the Nash equilibrium of a game in period 1 where the owner of the firm chooses α to maximize $\pi(p^*(\alpha,\beta), t^*(\alpha,\beta))$ and government chooses β to maximize $R(p^*(\alpha,\beta), t^*(\alpha,\beta))$. Let the equilibrium values be denoted by α^S,β^S and let $p^S \equiv p^*(\alpha^S,\beta^S)$ and $t^S \equiv t^*(\alpha^S,\beta^S)$. Then $(\alpha^S,\beta^S,p^S,t^S)$ is the subgame perfect equilibrium of the game. In Figure 3 point S depicts this subgame perfect equilibrium.

It can be shown that $\alpha^S, \beta^S > 1$ and $p^S(1+t^S) > p^N(1+t^N)$. That $\alpha^S,\beta^S > 1$ is easy to see from Figure 3. To see that consumer price is higher here than at the Nash equilibrium depicted in section 2, note that, for all p,t,

$$p\left(1+t\right) = \left(p - \alpha c/2\right)\left(1+t\right) + \alpha c\left(1+t\right)/2 \tag{11}$$

$$\text{and } p\left(1+t\right) = p\left(t + 1/2\beta\right) + p\left(1 - 1/2\beta\right). \tag{12}$$

Since in equilibrium the manager and the bureaucrat must be on their reaction functions, we can combine (11) and (8), and (12) and (10), to get, respectively:

$$p^S\left(1+t^S\right) = a/2b + \alpha^S c\left(1+t^S\right)/2 \tag{13}$$

$$p^S\left(1+t^S\right) = a/2b + p^S\left(1-1/2\beta^S\right). \tag{14}$$

From Figure 3 it is clear that either $p^S > p^N$ or $t^S > t^N$ or both. Without loss of generality, suppose $t^S > t^N$. From the definition of p^N and t^N it follows that $p^N(1 + t^N) = a/2b + c(1 + t^N)/2$. Since $\alpha^S > 1$, if $t^S > t^N$, it follows from (13) that $p^S(1 + t^S) > p^N(1 + t^N)$. On the other hand if $p^S > p^N$, we would get the same result starting from equation (14).

Since $p^S(1 + t^S) > p^N(1 + t^N)$, it follows that quantity produced in the subgame perfect equilibrium is less than that at N. Hence, this establishes our second proposition that when both the firm and the government are free to delegate their decisions the inefficiency that arises from a monopoly is aggravated.

It is interesting to observe that $\beta^S > 1$. Presumably the politician ought to have an interest in increasing the volume of sales of the industry (our incentive scheme allows for this). However this is not borne out in the subgame perfect equilibrium. In fact, bureaucrats striving to promote sales will face blocked promotions and get transferred to unsavory jobs.

5. Discussion and Concluding Remarks

In this paper we have examined the consequences of delegation within government and the firm on producer price, tax rate, consumer price and quantity produced. In doing so we have taken the tax rate to be *ad valorem* and the incentive schemes for both managers and bureaucrats to be related to sales. Following Vickers (1984) we could have used quantity instead of sales, or alternatively we could have tied up the bureaucrat's incentive to the profit of the firm. We could have worked with unit tax instead of *ad valorem* tax in all these alternative frameworks. But, we have checked, all qualitative results go through with all the above alternative formulations.

It is interesting to observe that even though both the owner and the government overemphasizes profit and revenue respectively in their incentive schemes, in the incentive *equilibrium* they end up with less profit and less tax-revenue compared with the Nash equilibrium. This is contrary to the delegation literature. For instance, in Fershtman and Judd (1987) in the incentive equilibrium of quantity competition both the firms shift the incentives away from profit and have less profit in equilibrium, while in the case of price competition the firms shift the incentives towards profit and enjoy higher profit in equilibrium. It is also worthwhile highlighting the result that even if we allow for the firm's profit in the incentive scheme of the bureaucrat, the owner ends up with lower profit in the subgame perfect equilibrium.

Two closely related papers discussing the effect on efficiency in the presence of a revenue-maximizing government in a strategic set-up are Anant et al. (1995) and Heywood and Pal (1996). But they have considered "strategic inefficiency" (the monopolist chooses an inefficient technology in Anant et al. (1995) and the spatial monopolist chooses inefficient location and mode of transportation in Heywood and Pal (1996)), while we have talked about standard inefficiency.

Finally, we want to distinguish our finding about increased inefficiency in the presence of a bureaucracy from the bureaucratic efficiency–inefficiency controversy in the corruption literature (Bardhan, 1996). In the latter either the bureaucrat

or the taxpayer or both are considered to be corrupt. In our framework both the bureaucrat and the businessman are lawful, yet we end up with an inefficient outcome.

We can only plead convenience for assuming linearity in the demand and cost functions and the incentive schemes. In generalizing our model it is also possible to consider different sequences of moves and decisions. However we know from related work and some back-of-the-envelope calculation of ours that these are easy to formulate and analyze once the basic model of this paper is fully grasped.

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Note

1. While the standard literature of bureaucratic behavior (Niskanen, 1971; McGuire et al., 1979) supports this revenue-maximization assumption of government, Anant et al. (1995) provide further justification for this assumption by arguing that, after considering all the expenditure precommitments (e.g., defense, interest payments, etc.), when it comes to taxation the compulsion of trying to keep the budget deficit low implies that government's objective becomes one of maximizing revenue collection. This justification is reinforced further for the developing countries undergoing structural adjustment programs which require fundamental fiscal changes. Outside agencies such as the donor bank or the IMF advise restoration of budget balance, a task which involves tax-revenue maximization as an essential component.