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# THE BABU AND THE BOXWALLAH

## *Managerial Incentives and Government Intervention*

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# THE BABU AND THE BOXWALLAH :
## Managerial Incentives and Government Intervention

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**Abstract**

A game is modelled where the government confronts a monopoly. The latter chooses price and maximises profit and the former chooses the ad valorem tax rate and maximises the tax-revenue collected. We allow the government and the monopoly to delegate the final decision-making to, respectively, a bureaucrat and a manager. The incentive equilibrium of the model is characterised. It is shown that the ability to delegate decisions heightens the inefficiencies that arise from a monopoly.

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# THE BABU AND THE BOXWALLAH :
## Managerial Incentives And Government Intervention

### 1. Motivation

In the light of the experience of many Third World countries and the recent liberalization effort in socialist economies it is now recognized that in large parts of the world a firm's strategic decisions are provoked not as much in response to what other firms are doing as in response to what the government or the bureaucrat is doing. This has led to a growing literature on government-firm strategic interactions (see,eg., De Fraja and Delbono,1989 ; Anant, Basu and Mukherji,1993). The present paper addresses a specific issue within this broad area.

Following Vickers (1984), Fershtman and Judd (1987) and Sklivas (1987) we begin by recognising that principal-agent models acquire a new rationale in the presence of strategic interactions. A firm's owner may then 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 wishes to maximize tax-revenue collection. 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 pejoratively called in India - giving him suitable incentives. For simplicity, we assume that the tax rate in question is an ad valorem tax rate. The incentive that the government or minister gives to the bureaucrat need not be financial. In India 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 maximise profit. But the owner is free to appoint a manager - or a boxwallah, as he is at times pejoratively 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 have shown that the ability to delegate decisions heightens the inefficiencies that arise from a monopoly. An interesting corollary that comes out of 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. In section 3 we model the case where the government is a monolithic organisation while the firm has two tiers--the owner and the manager. We then go on to model the case where the government has also two levels--the ministry and the bureaucrat--as described

above. Section 5 concludes the paper discussing possible extensions and alternative frameworks for analyzing the problem.

## 2. The Benchmark Model

We are concerned with an industry where the demand function is :

$$q = a - bp \qquad (1)$$

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 :

$$C = cq \qquad (2)$$

where $c > 0$.

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 ($\Pi$) and the government's total tax-revenue collection (R) are given by, respectively :

$$\Pi(p,t) = (p - c)(a - bp(1+t)), \qquad (3)$$

$$R(p,t) = tp(a - b\,p(1+t)). \qquad (4)$$

We, in this section, assume that both the government and the firm are monolithic organisations (i.e., there is no delegation within either of the two) and the government chooses t in order to maximise R and the owner of the firm chooses p to maximise $\Pi$.

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

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

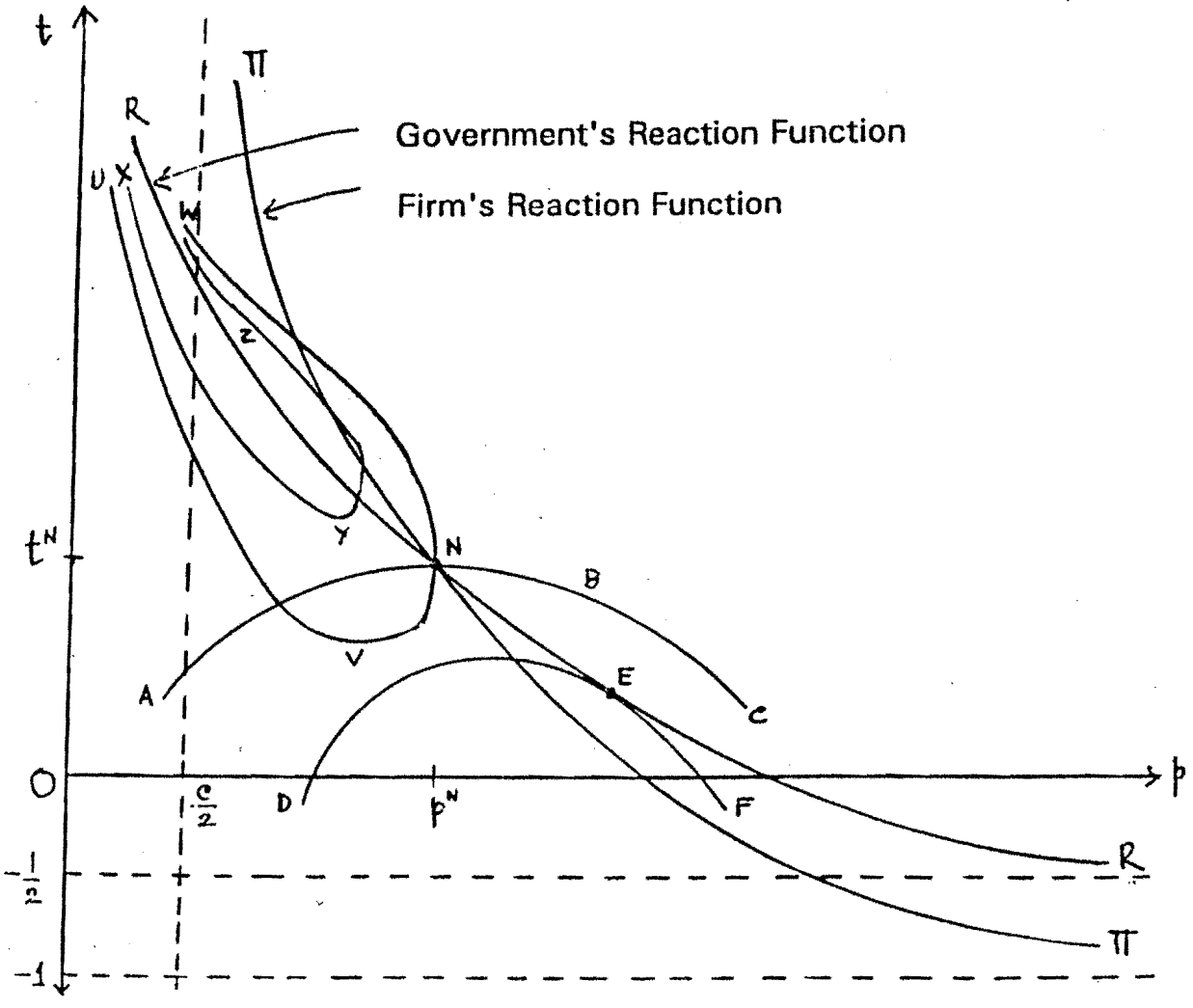
The government's reaction function is given by $\partial R/\partial t = 0$, and is :

$$p(t+(1/2)) = a/2b. \qquad (6)$$

This is exactly the case considered in Anant, Basu and Mukherji (1993), 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, viz, ABC & DEF and two iso-tax-revenue curves of the government, viz, UVW & XYZ.

Figure 1



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, Basu and Mukherji (1993), this Nash equilibrium is inefficient compared to 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

In this section let us think of the government as in the benchmark model - a monolithic organisation that chooses t in order to maximise R.

As far as the firm is concerned, the owner wants to maximise $\Pi$, 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 $\alpha$ and set the manager's incentive to be as follows :

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

In other words, the owner chooses an $\alpha$ and tells the manager that her salary is a positive monotone transform of I. Thus

the manager's aim is to maximise 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 $\alpha$ free to be set at any level.

We now consider the two stage game where the owner chooses $\alpha$ in period 1 and in period 2 the manager and the 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 $\alpha$ given.

Clearly she sets $\partial I/\partial p = 0$. In other words, her reaction function is :

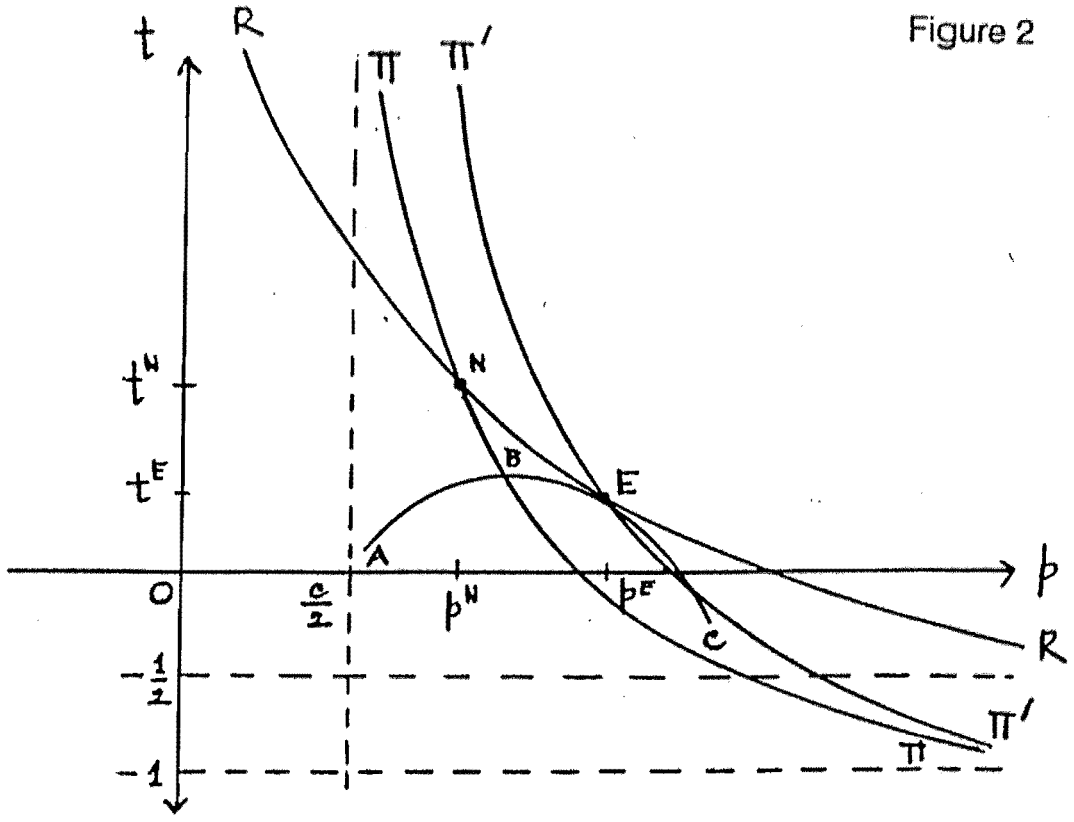
$$(p - \alpha c/2)(1+t) = a/2b. \qquad (8)$$

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, the government's 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 $\alpha$ in period 1. Hence, as in the Fershtman-Judd model (see Basu,1993), we are headed towards a Stackelberg type solution with the firm as leader. In figure 2 this happens at E, where ABC is the owner's isoprofit curve.

Figure 2




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

$$\alpha^E = \arg\max_{\alpha} \Pi(p(\alpha),t(\alpha))$$

and $p^E = p(\alpha^E)$, and $t^E = t(\alpha^E)$.

The following results are easy to derive. In <u>equilibrium</u>,

(a) $\alpha^E > 1$ ,

(b) $p^E > p^N$ ,

(c) $t^E < t^N$ ,

and (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,

$$p(1+t) = p(t + (1/2)) + p/2.$$

Hence, by (6) :

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

And again, by (6) :

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

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 at N. It was shown in Anant, Basu and Mukherji (1993) that at N the inefficency is greater than in a usual monopoly equilibrium. Hence, what we have establised is that once a firm is free to hire a manager as a strategic instrument against the government the inefficiency becomes even more acute.

## 4. Delegation Within Government

In sections 2 and 3 we have portrayed the government as a monolithic organisation. In reality the bureaucrats play a crucial and distinct role from the one played by the 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 allowing the government also to delegate decisions to the bureaucrat in order to gain strategic advantages over the firm.

In the earlier sections we modelled the 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 (e.g., increasing social welfare, for which increasing sales or output of the economy may be a good proxy), while decision-making at the micro level is delegated to the bureaucrats. Keeping in line with the above idea suppose now that the government's objective is to maximise 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 :

$$B(\beta,p,t) = \beta(\text{Tax Revenue}) + (1-\beta)\text{Sales}$$
$$= \beta tp(a - bp(1+t)) + (1-\beta)p(a - bp(1+t)). \quad (9)$$

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 moments 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. What we are assuming is the net bundle of such incentives 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 observe what value $\beta$ takes in equilibrium.

In this section the game we are considering is as follows. In period 1, the owner chooses $\alpha$ and the government chooses $\beta$. 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 :

$$(t + (1/2\beta))p = a/2b. \qquad (10)$$

Comparing 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 $\beta < 1$.

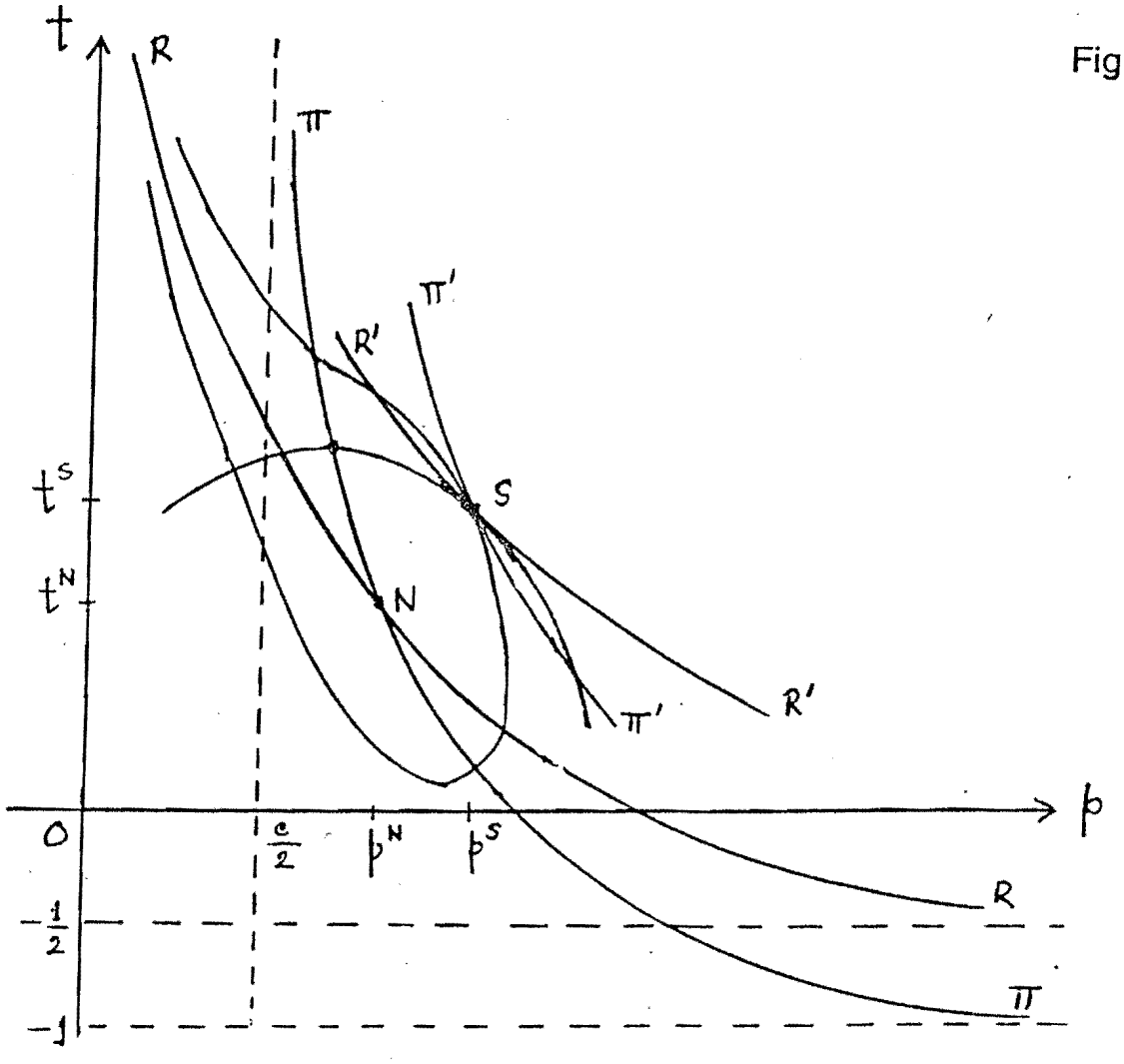



Figure 3

Given $(\alpha,\beta)$, the equilibrium in period 2 is derived by solving (8) and (10). Let this be denoted by $p^*(\alpha,\beta)$ and $t^*(\alpha,\beta)$. The equilibrium values of $\alpha$ and $\beta$ are then the Nash equilibrium of a game where the owner of the firm chooses $\alpha$ to maximise $\Pi(p^*(\alpha,\beta), t^*(\alpha,\beta))$ and the government chooses $\beta$ to maximise $R(p^*(\alpha,\beta), t^*(\alpha,\beta))$. Let the equilibrium values be denoted by $\alpha^s,\beta^s$ and let $p^s \equiv p^*(\alpha^s,\beta^s)$ and $t^s \equiv t^*(\alpha^s,\beta^s)$. 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 $\alpha^s,\beta^s > 1$ are 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, $p(1+t) = (p -(\alpha c/2))(1+t) + \alpha c(1+t)/2$ (11)

and $p(1+t) = p(t+(1/2\beta)) + p(1-(1/2\beta))$. (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 :

$$p^s(1+t^s) = a/2b + \alpha^s c(1+t^s)/2 \quad (13)$$

$$p^s(1+t^s) = a/2b + p^s(1-(1/2\beta^s)) \quad (14)$$

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 at N. Hence, this establishes the inefficency result.

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 unsavoury jobs.

As we have noted, both the owner and government shift the incentive away from sales and this is, in fact, the cause of inefficency in our framework.

## 5. Concluding Remarks

In this paper we have examined the consequences of delegation within the government and the firm on producer price, tax rate, consumer price and quantity produced. In doing so we have taken the incentive scheme for both managers and bureaucrats to be related to sales. Following Vickers (1984) we could have used quantity instead of sales. But, we have checked, all qualititative results go through even in that case.

We can only plead convenience for assuming linearity in the demand and cost functions and the incentive schemes. In generalising our model it is also possible to consider different

sequences of moves and decisions. We however know from related work and some back-of-the-envelope calculation of ours that these are easy to formulate and analyse once the basic model of this paper is fully grasped.

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