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**Corruption, Tax Evasion  
and the Laffer Curve**

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## *Abstract*

In a corrupt tax administration a rise in tax rate sets about complicated strategic decision moves by both tax payers as also tax administrators. It is shown that in some circumstances, this may bring about a Laffer like behaviour of overall tax revenue, ie a higher tax rate may result in a smaller net revenue for the government.

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# 1. Introduction

The theoretical possibility for a Laffer Curve outcome has been generally sought in increased work effort, or more generally, in increased factor supplies, resulting from the incentive of higher post-tax income per unit of effort or supply [eg Minford and Ashton (1991)]. The present paper explores the possibility of a Laffer outcome from a different perspective. In a tax administration with bureaucratic corruption, variation of the tax rate leads to an alteration of strategic decisions among two sets of agents: corrupt tax officials and tax payers. For corrupt officials, a higher tax rate presents the possibility of a higher negotiated bribe rate for clearing under-disclosed income returns. A higher bribe rate may also increase the number of corrupt officials by overcoming the implicit moral or psychological hurdles of erstwhile honest officials. Tax payers on the other hand, respond by strategically altering the amount of income disclosed. Net revenue is the end result of these strategic moves by taxpayers and officials, the enforcement cost being determined by the government's own audit intensity decision. A Laffer outcome in this context is a situation where a tax cut leads to a sufficiently higher level of disclosure leading to higher tax collection. Our paper explores the conditions for such an outcome in the context of an interactive model of tax evasion and corruption.

While the literature on tax evasion is fairly large, that on the collusion between tax payers and revenue officials is less so. But bureaucratic corruption in tax administration is widespread in many countries as pointed out in Acharya and associates (1985), Virmani (1987), Chu (1990) and Goswami, Sanyal and Gang (1991). Formal modeling of the problem has been attempted in Lui (1986), Goswami, Sanyal and Gang (1991) and Chander and Wilde (1992). Both Goswami, Sanyal and Gang (1991) and Chander and Wilde (1992) use a class of interactive models assuming that while the government must make prior announcement about the tax and penalty scheme, it need not precommit to an audit strategy. Taxpayers choose their optimal declarations assuming alternative audit probabilities, while the government decides its optimal audit scheme given the tax returns. Such interaction between taxpayers and the government is usually characterised in terms of sequential Nash equilibria. These models have been widely used in the analysis of tax evasion in a non-corrupt regime, examples being Greenberg (1984), Graetz, Reinganum and Wilde (1986), Reinganum and Wilde (1986), and Melumad and Mookherjee(1989)<sup>1</sup>.

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<sup>1</sup> Tax evasion has been also modelled using the principal agent approach, where the government precommits to not only the tax and fine rates but also the audit probability. Some examples are Allingham and Sandmo (1972),

In this analysis we will adapt and extend the model developed by Goswami, Sanyal and Gang (1991), referred to below as the GSG model. While Chander and Wilde (1992) have analysed the equilibrium solutions for a variety of situations in a regime of corruption and super-audits, we choose the GSG model for the ease with which the parameters of corruption (e.g., the bribe rate and the proportion of corrupt auditors) can be endogenised in that model, and also because we do not address the question of super-audits for reasons discussed in Section 5 below. We discuss the possibility of a Laffer outcome in the context of two distinct models. In the first model, some auditors are corrupt, and decide on a bribe rate based on strategic considerations, which is taken as parametric by tax payers. In the second model, the proportion of corrupt auditors is also endogenous, and is determined by the tax and fine rates set by the government.

In Section 2 we present the basic properties of the GSG model to be used in this paper. Section 3 analyses the comparative statics of this model under tax variation and explores the possibility of Laffer-like outcomes. Section 4 analyses endogenous corruption, and Section 5 concludes.

## 2. The Basic GSG Model

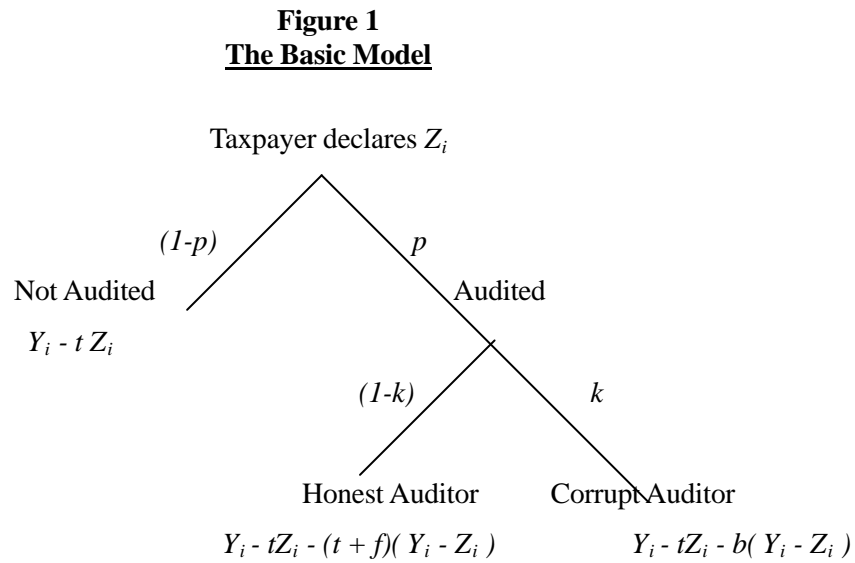
1. There are  $N$  taxpayers, each earning a true income  $Y_i$  but declaring  $Z_i \leq Y_i$  in their tax returns. There are no habitually honest tax compliers, or pure salary earners, whose taxes are deducted at source and thus have little scope for misreporting.
2. Auditing always reveals the true income. The probability of audit ( $p$ ) is chosen by the government, and not by the auditors. Auditing involves a constant unit cost ( $c$ ). If a taxpayer is audited and found to have cheated, the extra levy - be it the additional tax plus penalty or the bribe - is on the size of the offence,  $(Y_i - Z_i)$ .
3. The tax rate ( $t$ ) and the fine rate ( $f$ ) are proportional, fixed by the government, known to all, and remain unchanged during the decision making period.
4. There is no wealth or bankruptcy. Hence, taxes and fines can, at most, drive a taxpayer's disposable income to zero.

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Srinivasan (1973), Reinganum and Wilde (1985), Border and Sobel (1987), Mookherjee and P'Ng (1989), and Cremer, Marchand, and Pestieau (1990),

5. Of the auditors, a proportion ( $k$ ) are corrupt, while the remaining ( $1-k$ ) are incorruptible. The basic model takes this proportion as given, while in Section 4 we explore the implications of endogenous  $k$ .
6. The model is derived under the framework of risk neutrality [Graetz, Reinganum and Wilde (1986)].

The structure of the model is shown in Figure 1.



We start with the bribe negotiation process where a tax-evader has been caught by a corrupt auditor demanding a bribe (at a rate  $b$ ) to issue a clean chit. The basic GSG model assumes no super-audits or monitoring of the auditors.<sup>2</sup> Moreover, auditors do not make precommitments to accept lower bribes so as to induce more evasion; instead, they must bargain upon detecting evasion. The auditor's gain from a successful negotiation is the bribe itself, or  $b(Y_i - Z_i)$ . The taxpayer's gain is the difference between the bribe and the tax plus fine that would have to be paid otherwise:  $[Y_i - tZ_i - b(Y_i - Z_i)] - [Y_i - tZ_i - (t+f)(Y_i - Z_i)]$ . In a two-person, fixed threat situation, the Nash bargaining solution gives the bribe rate that maximises the product gains from negotiation.

$$(1) \quad \underset{b}{Max} V = [b][-b + (t + f)](Y_i - Z_i)^2 \Rightarrow b^* = \left( \frac{t + f}{2} \right)$$

<sup>2</sup> For some justification of this assumption see Klitgaard (1988)].

A taxpayer will cheat if the expected gains from misreporting exceeds the returns from honesty. We assume that in the case of indifference, the taxpayer chooses to be honest. So, an agent cheats and, given risk neutrality, declares zero income if

$$(2) \quad (1-p)(Y_i - tZ_i) + p(1-k)[Y_i - tZ_i - (t+f)(Y_i - Z_i)] + pk[y_i - tZ_i - b^*(Y_i - Z_i)] > Y_i(1-t)$$

Substituting  $b^*$  from (1) yields the conditions that if

$$(3.1) \quad p < p^* = \frac{2t}{(2-k)(t+f)} \quad \text{then all cheat and } Z_i = 0 \text{ for all } i, \text{ and}$$

$$(3.2) \quad p \geq p^* \quad \text{then all truthfully declare, ie } Z_i = Y_i \text{ for all } i.$$

From (1), truth revelation through audits is feasible ( $0 \leq p^* \leq 1$ ) so long as the proportion of corrupt auditors does not exceed an exogenously determined ratio given by

$$(4) \quad k \leq \left( \frac{2f}{t+f} \right)$$

Equation (4) implies that if there are institutional limitations on how high fines can go, then a large  $k$  can threaten the use of audits as a truth revealing device.<sup>3</sup>

The government's objective is to maximise revenue net of audit costs, that is choosing an audit probability that maximises revenue ( $R$ ), given by

$$R = tZ + p[(1-k)(t+f)(Y-Z) - Nc]$$

where  $Y = \sum Y_i$  and  $Z = \sum Z_i$ . In our risk-neutral model, the government has only two options:  $p = p^*$  (where everyone declares honestly), or  $p < p^*$  (where everyone cheats).

$$(5.1) \quad \text{When } p = p^*, \text{ revenue is } R^* = tY - p^* Nc = \left( \frac{t}{(2-k)(t+f)} \right) [(2-k)(t+f)Y - 2Nc]$$

$$(5.2) \quad \text{When } p < p^*, \text{ revenue is } R = p[(1-k)(t+f)Y - Nc]$$

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<sup>3</sup> As an example, consider the Indian data. The average income tax rate is 20 percent, and the penalty rate is approximately 10 percent of undisclosed income. According to the model, auditing can produce truthful reporting so long as the proportion of corrupt auditors does not exceed 67 percent. However, a 1985 survey (The Policy Group, 1985) suggests that at least 76 percent of the government's auditors are corrupt.



**Proposition 1:** *Net revenue earned from a truth revealing audit probability  $[R^*(p^*)]$  always exceeds net revenue  $[R(p < p^*)]$  through audits, taxes, and penalties in the cheating phase.*

It is easily verified by using (3.1) and (5.1) to write  $R^*$  as

$$(6) \quad R^* = \frac{p^*}{2} [(2 - k)(t + f)Y - 2Nc] = p^* [(1 - k/2)(t + f)Y - Nc]$$

Comparing this with (5.2), it follows that for any  $p < p^*$ ,  $R^* > R(p)$ , since by assumption  $0 < k < 1$ .

In establishing audit policy the government seeks to maximise net revenue. From equation (3.1) and (3.2) we see that there are four possible configurations relevant to the government's audit policy. However, since by comparing (5.2) and (6) we know that  $R^*$  is always positive when  $R$  is positive, we need only examine three possibilities:

- (i)  $R^*(p^*) > 0$  and  $R(p < p^*) > 0$ ,
- (ii)  $R^*(p^*) > 0$  but  $R(p < p^*) \leq 0$ ,
- (iii)  $R^*(p^*) \leq 0$  and  $R(p < p^*) < 0$ .

These configurations may be thought of as different audit cost regimes.

(i) *Low Audit Cost (LAC):* Both  $R^*$  and  $R$  are positive. If truth revelation is feasible ( $p^* \leq 1$  given  $t, f$ , and  $k$ ) the government maximises net revenue by choosing  $p^*$ . However, if  $t, f$ , and  $k$  are such that  $p^* > 1$ , the government should choose  $p = 1$  and audit everyone. The optimal audit policy is  $p = \min(p^*, 1)$ .

(ii) *Intermediate Audit Cost (IAC):*  $R^* > 0$ , but  $R \leq 0$ . The optimal policy is to choose  $p^*$  if  $p^* \leq 1$ . However, if  $p^* > 1$ , there is no positive  $p < p^*$  where the government will earn positive net revenue through audits and is best off auditing no one.

(iii) *High Audit Cost (HAC):*  $R^* \leq 0$ , and  $R < 0$ , and auditing always results in non-positive net revenue. In such a regime, the optimal strategy is to choose  $p = 0$ , that is, not to audit.

Since  $R$  and  $R^*$  are functions of  $t$ , a rise in tax rate can lead the economy from one cost regime into another. In particular, continuous increases in the tax rate leads the economy from a high, through intermediate to a low audit cost regime.

### 3. Varying the Tax Rate & the Possibility of a Laffer Outcome

#### 3.1 Variation in Tax Rate Without a Regime Change

The Laffer property of net revenue can be analysed by examining the effect of tax rate variation on the net revenue of the government. We begin by noting that as the tax rate rises,  $p^*$  rises, too, since from (3.1)

$$(7) \quad \left( \frac{\partial p^*}{\partial \alpha} \right)_k = \frac{2f}{(2-k)(t+f)^2} > 0$$

**Proposition 2:** *Given the proportion of corrupt auditors, net revenue is always non-decreasing in the tax rate if (i) the government chooses its audit probability optimally and (ii) tax variation does not lead to a regime change.*

To examine the net revenue effect of an increase in the tax rate, note that

$$(8) \quad \left( \frac{\partial R^*}{\partial \alpha} \right)_k = Y - \frac{2fNc}{(2-k)(t+f)^2}, \text{ or rewriting,}$$

$$\left( \frac{\partial R^*}{\partial \alpha} \right)_k = \frac{f}{(2-k)(t+f)^2} [(2-k)(t+f)Y - 2Nc] + \left( \frac{t}{t+f} \right) Y$$

By definition, in the LAC and IAC regimes  $R^* > 0$ . Hence, from (5.1),  $[(2-k)(t+f)Y - 2Nc] > 0$ . Thus, in these two regimes, the net revenue from inducing truthful reporting rises with the tax rate. In the LAC regime, if  $p^* > 1$ , the optimal choice is  $p = 1$ , and net revenue ( $R$ ) rises in the tax rate:  $(\partial R / \partial \alpha) = (1-k)Y > 0$ . In the IAC state, no taxpayer is audited if  $p^* > 1$ , and  $R$  is non-decreasing in  $t$ . Under a HAC regime the optimal choice is not to audit, irrespective of whether  $p^*$  is feasible or not, and  $R^*$  as well as  $R$  are non-decreasing in the tax rate.

Thus as long as the economy remains in the same regime, and the government chooses its audit probability optimally, tax variations do not result in any Laffer-like possibility. However if the variation in tax rate moves the economy across regimes, or if the government fails to enforce the optimal audit level, interesting possibilities emerge, in some cases leading to a Laffer-like response.

### 3.2 Changes in Regime

To study the effect of tax variation across regimes, we begin with an arbitrary tax rate and pursue its rise until the regime changes. For example, suppose the economy is starting from the IAC regime, tax rate is  $t$  and  $p^*(t)$  is feasible. So current net revenue is  $R^*[p^*(t)] > 0$ . From (3.1), given an arbitrary  $k$  and a fine rate,

$$p^* \in [0,1] \Leftrightarrow t \in \left[ 0, \frac{(2-k)f}{k} \right]$$

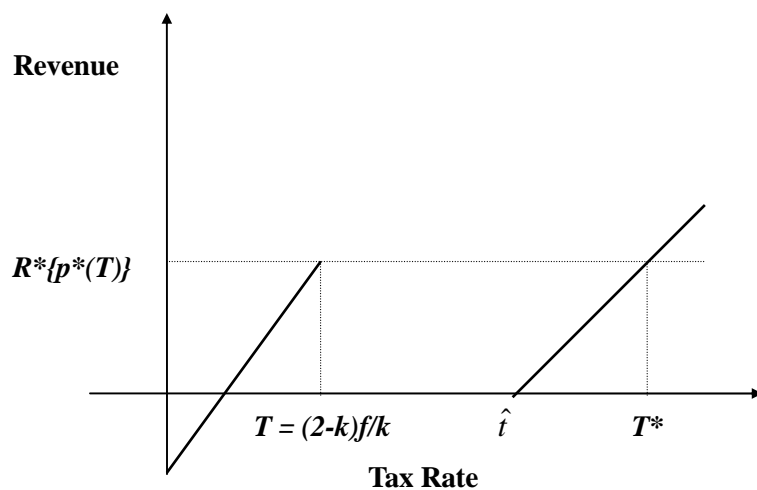
Define  $\hat{t}$  as the lowest tax rate that yields a positive net revenue in the state where all taxpayers cheat. If  $\hat{t}$  lies between zero and  $(2-k)f/k$ , the regime shifts to LAC as the tax rate rises to  $\hat{t}$  in the feasible  $p^*$  region. Net revenue continuously rises in  $t$  before and after  $\hat{t}$ , and there is no Laffer possibility.

However if  $\hat{t}$  exceeds  $(2-k)f/k$ , then  $p^*$  exceeds 1 and a Laffer-like situation emerges. Consider the tax rate  $T = (2-k)f/k$ , where  $p^* = 1$ . As the tax rate rises up to this point, the economy continues in the IAC regime. The optimal audit probability  $p^*$  is enforced and revenue  $R^*$  increases continuously to become  $TY - Nc$  at  $T$ . As the tax rate increases beyond  $T$ ,  $p^*$  becomes  $> 0$ . In the region  $T < t < \hat{t}$ , the economy is still in IAC. So the government can not set audit at any positive  $p < 1$ , and sets it to zero. Thus there is a discontinuity in the revenue function at  $T$  and it falls to zero immediately after  $T$ . It stays at that level until  $t$  exceeds  $\hat{t}$  and beyond that point it again increases with the tax rate. The situation is shown in Figure 2.1, where revenue collected at any tax rate between  $T$  and  $T^*$  could also be achieved at some lower tax rate. This can be called a weak Laffer possibility.

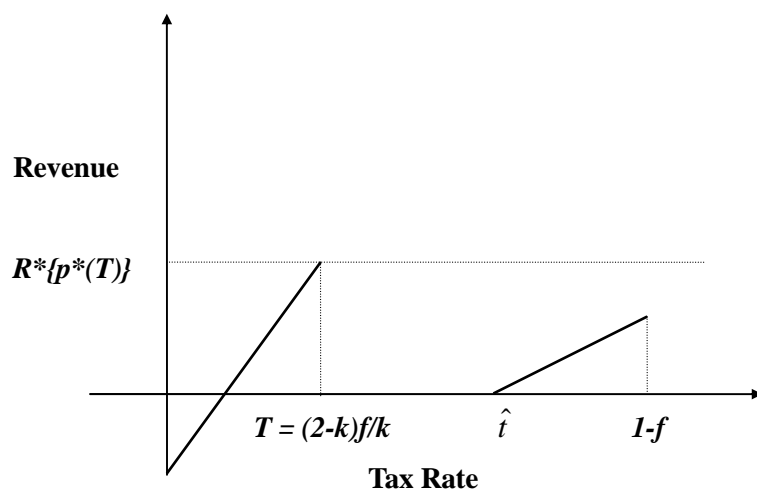
Further, in the absence of wealth and bankruptcy, the maximum tax rate possible in the model is  $1-f$ . Therefore it is also possible that the second rising segment gets truncated at  $1-f$ , where the net revenue is still below that achieved at  $T$ . This could be described as a strong Laffer possibility, where the revenue achieves a maximum at some rate  $T$  and is always below it at all higher tax rates. This situation is shown in Figure 2.2. These considerations lead us to the following proposition:

**Proposition 3:** *If the variation in tax rate leads to a regime shift and the proportion of corrupt auditors is exogenously given, net revenue may fall with a rise in the tax rate.*

**Figure 2.1**  
**A Weak Laffer Possibility**



**Figure 2.2**  
**A Strong Laffer Possibility**



### 3.3 Sub-optimal Auditing

**Proposition 4:** *If the government chooses its audit probability arbitrarily and the proportion of corrupt auditors is exogenously given, net revenue may fall with a rise in the tax rate.*

This is best analysed by focusing on the LAC regime - the best-case scenario for the government. Suppose the revenue collecting authority decides upon an audit probability  $\bar{p}$ , and  $\bar{p} > p^*$ , given  $t$ . From (7), a rise in the tax rate increases  $p^*(t)$ . As long as  $p^*(t) \leq \bar{p}$ , everyone declares honestly and the net revenue is  $[tY - \bar{p} Nc]$ , which rises with  $t$  at the rate of  $Y$ . Given  $\bar{p}$ , define  $\bar{t}$  as the tax rate where  $p^*(\bar{t}) = \bar{p}$ . At  $\bar{t}$  there will be a discontinuity in the net revenue, since immediately beyond it taxpayers start cheating and declaring zero income. Beyond this point of discontinuity, ie for  $t > \bar{t}$ , the net revenue is  $\bar{p} [(1-k)(t+f)Y - Nc]$ , which again increases in  $t$ , though at a lower rate  $\bar{p} (1-k)Y < Y$ . Depending on the parameter values, three qualitatively different configurations shown in Figures 3.1, 3.2, and 3.3 can be identified. We identify them as (i) strict Laffer, (ii) weak non-Laffer, and (iii) strict non-Laffer respectively.

In our framework, a Laffer outcome consists of two components. First, an infinitesimal increase in  $t$  above  $\bar{t}$  should bring about a drop in net revenue. This requires, at the limit

(9)

$$\bar{t}Y - \bar{p}Nc > \bar{p}[(1-k)(\bar{t} + f)Y - Nc] \Rightarrow k > 1 - \frac{\bar{t}}{\bar{p}(\bar{t} + f)}$$

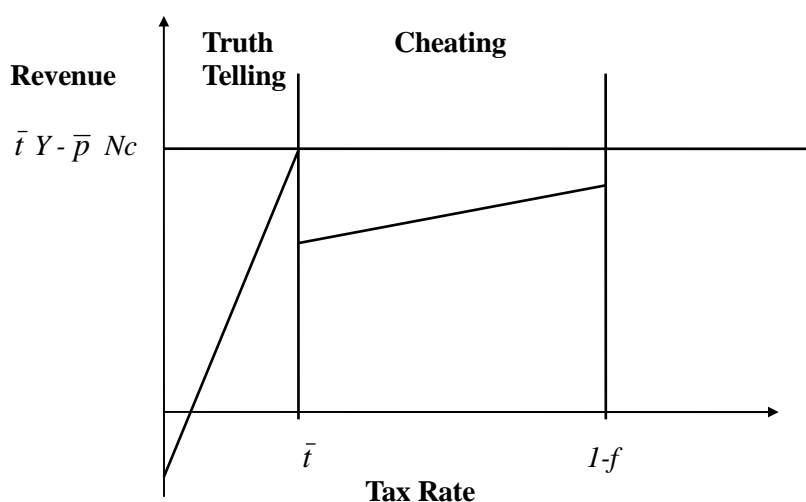
Second, in a Laffer situation, it should be possible to obtain the revenue from any tax rate exceeding  $\bar{t}$  by levying some tax rate,  $t < \bar{t}$ . The maximum revenue under truth revelation is  $(\bar{t}Y - \bar{p}Nc)$ , when  $t = \bar{t}$ . For  $t > \bar{t}$ , the net revenue is  $\bar{p} [(1-k)(t+f)Y - Nc]$ . The tax rate above  $\bar{t}$  that equates the two is  $[\{\bar{t} / \bar{p} (1-k)\} - f]$ . Without wealth and bankruptcy, the maximum tax that can be levied when a taxpayer is caught cheating is  $(1-f)$ . Hence, the second component of a Laffer outcome is

$$(10) \quad \frac{\bar{t}}{\bar{p}(1-k)} - f > (1-f) \Rightarrow k > 1 - \frac{\bar{t}}{\bar{p}}$$

Inequalities (9) and (10) describe necessary features of a strict Laffer situation, and we can classify the possible outcomes by checking whether or not these inequalities hold. Note that (9) is binding: if (9) does not hold, neither does (10).

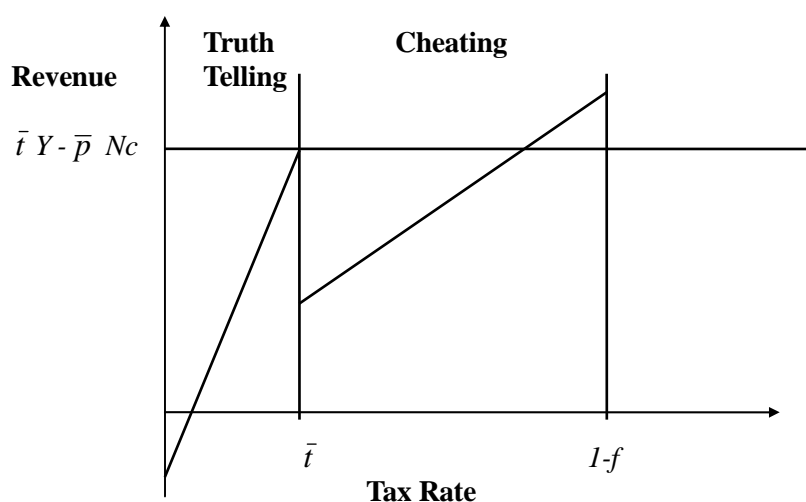
(i) *Strict Laffer*: The proportion of corrupt auditors is high enough for both (9) and (10) to hold. The net revenue earned by levying *any* tax rate above  $\bar{t}$  can be surpassed by charging a tax less than  $\bar{t}$ . In this situation it may be deemed better to encourage truthful reporting at a lower tax rate than to cause cheating and earn back the same revenue through fines from the efforts of honest auditors at a higher tax rate. The outcome is shown in Figure 3.1.

**Figure 3.1**  
**Strict Laffer**



(ii) *Weak non-Laffer*: Only (9) holds, that is,  $[1 - \{\bar{t} / \bar{p} (t+f)\}] < k < [1 - (\bar{t} / \bar{p})]$ . In such instances, there is a region in the cheating zone where charging taxes higher than  $\bar{t}$  can yield greater revenue compared to any truth telling tax rate. This is illustrated in Figure 3.2

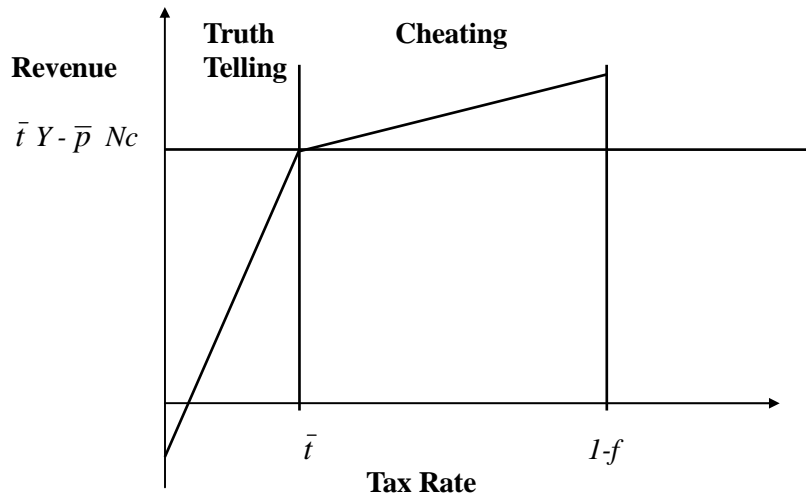
**Figure 3.2**  
**Weak Non-Laffer**



The weak non-Laffer situation can be illustrated by the Indian data, where  $k = 0.76$ ,  $t = 0.2$ , and  $f = 0.1$ . Suppose the government sets an arbitrary (and large)  $\bar{p} = 0.4$ . This implies  $\bar{t} = 0.0333$  -- only a tax rate less than or equal to 3.33 per cent can induce truthful reporting. With  $\bar{t} = 0.0333$ , condition (9) holds (since  $k$  is greater than 0.38), but (10) does not (since  $k$  is less than 0.9175). In this example, any tax rate between 3.33 per cent and 24.4 per cent can be also obtained at some rate below 3.33 per cent. This is the weak-Laffer zone. Beyond 24.4 per cent rate of taxation, the revenue obtained is greater than what could be obtained at any lower tax rate, and the Laffer property disappears.

(iii) *Strict non-Laffer*: Here, (9) does not hold. This describes economies where the government's auditors are largely or entirely honest. In such fortuitous circumstances, the government can certainly do better by being Machiavellian - raising taxes so that  $\bar{t} > t$ , inducing cheating, and then getting more revenue from the tax and penalties. This is shown in Figure 3.3.

**Figure 3.3**  
**Strict Non-Laffer**



The three outcomes are closely connected to the extent of corruption within the revenue collecting department. Where corruption is excessive - both (9) and (10) hold - the government faces a strong Laffer outcome, and must be content with  $[\bar{t} Y - \bar{p} Nc]$ , however small that might be.<sup>4</sup> Economies with honest bureaucracies will not face a Laffer outcome in the enforcement sense of the term. Of interest are cases that belong to the intermediate corruption range. A large number of combinations of  $k$ ,  $f$ , and  $\bar{p}$  can yield weak non-Laffer outcomes where (9) holds but (10) does not. Consider two states with  $\{k = 0.3, f = 0.2, \bar{p} = 0.3\}$ , and another with  $\{k = 0.2, f = 0.5, \bar{p} = 0.4\}$ , which describe quite different enforcement situations. These, respectively, generate  $\bar{t} = 0.0685$  and  $\bar{t} = 0.2813$ , and both produce weak non-Laffer outcomes. In the first case, any tax rate exceeding 12.62 per cent can produce higher net revenue under cheating than with truth revelation; in the second, the tax rate must exceed 37.89 percent. A government need not be concerned about pushing the average tax rate beyond 12.62 percent, but raising it above 38 per cent is quite another matter.

<sup>4</sup> Having to live with the maximal truth telling revenue is not necessarily a comforting thought for the government. The higher the proportion of corrupt auditors, the lower it is, for a given  $p$ . So, the government may be able to encourage honest reporting, and yet suffer the consequences of having inadequate net revenue.



## 4. Endogenous Corruption and The Laffer Behavior

We now drop the assumption that the proportion of corrupt auditors is fixed and, make it dependent on the tax and fine rates. Specifically, we assume  $k = k(t, f)$ , with  $k_t > 0$ , and  $k_f > 0$ .<sup>5</sup> The rationale for this assumption is that the equilibrium bribe rate rises with both  $t$  and  $f$  [see equation (1)]. A higher bribe rate is expected to overcome the implicit psychological and moral costs of a higher number of auditors which thus raising the proportion of corrupt auditors in the system. This was not true in Sections 2 and 3, where honest auditors could never be bribed. All other assumptions remain the same.

**Proposition 4:** *With endogenous corruption and  $k$  depending upon  $t$  and  $f$ , the government's net revenue may fall with an increase in the tax rate, even when audits are chosen optimally.*

First, we examine how a rise in the tax rate affects the truth revealing audit probability. From (3.1)

$$(11) \quad \left( \frac{\partial p^*}{\partial t} \right)_{k=k(t,f)} = \frac{2}{(2-k)^2(t+f)^2} [(2-k)f + tk_t(t+f)] > 0 \quad \text{and}$$

$$\left( \frac{\partial p^*}{\partial t} \right)_{k=k(t,f)} > \left( \frac{\partial p^*}{\partial t} \right)_{k=\bar{k}}$$

Since the proportion of corrupt auditors increases with the tax rate, the incentive to cheat rises faster with tax rate now than when  $k$  was given. The rise in  $p^*$  with endogenous corruption has to be greater than the case when  $k$  was exogenous.<sup>6</sup>

Suppose the initial tax rate is such that  $p^*$  is feasible. Let  $t_m$  be the highest tax rate that is consistent with truthful declaration, ie  $t_m = (2-k)f/k$ . As the tax rate rises,  $t_m$  falls, since  $(\partial t_m / \partial t) = -(2fk_t)/k^2 < 0$ , and reduces the domain in which taxes can encourage truthful reporting. In this shrinking domain,

<sup>5</sup> For simplicity, we use a reduced form of the corruption function. It might be preferred to have the extent of corruption determined as an outcome of optimising decisions of the auditors.

<sup>6</sup> This is similar to a result derived by Chander and Wilde (1992) which states that if there have to be audits in a corrupt enforcement regime, then the audit intensity must be greater than in situations with honest income tax officers.

$$(12) \quad \left( \frac{\partial R^*}{\partial t} \right)_{k=k(t,f)} = Y - \frac{2Nc}{(2-k)^2(t+f)^2} [(2-k)f + tk_t(t+f)] \geq < 0$$

depending on the relative strength of  $t$ ,  $k$ , and  $k_t$ . . The sufficient condition is

$$(13) \quad \left( \frac{\partial R^*}{\partial t} \right)_{k=k(t,f)} \geq < 0$$

$$\text{as } k_t \leq < \Rightarrow \frac{(2-k)}{2t} \left[ \frac{(2-k)(t+f)Y}{Nc} - \frac{2f}{t+f} \right]$$

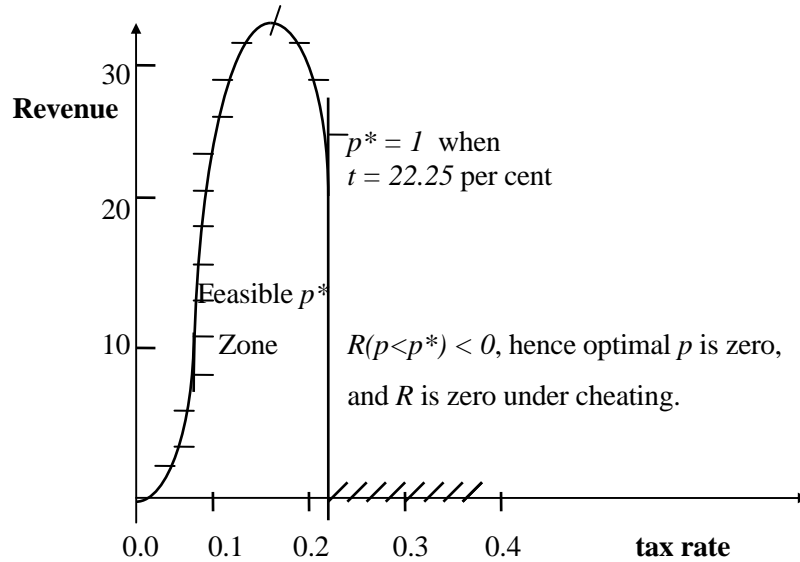
If  $k_t > 0$  and  $k_{tt} > 0$ , then, at low tax rates, the proportion of corrupt auditors is small and increases slowly so the positive revenue effects of an increasing tax rate dominate. Hence,  $R^*$  increases. When both  $k_t$  and  $k_{tt}$  are positive, there *can* be a critical tax rate where (13) holds with equality, and net revenue is at its maximum. Thereafter, the increase in corruption outweighs the benefits of raising taxes, and when that occurs,  $R^*$  falls. Thus, certain corruption functions can generate smooth, inverted-U Laffer-type curves even in situations where the government acts optimally and chooses an audit probability in the truth revealing zone.

For simplicity, consider a corruption function depending only on the tax rate, given by  $k = \min[e^{3t} - 1, 1]$ . Also assume that the fine rate is 0.2,  $Y = 1000$ , and  $Nc = 200$ . Substituting the function in (3.1), sustaining  $p^* \leq 1$  implies that the tax rate cannot exceed 22.25 percent. It can be checked that  $R^*$  is maximum at a tax rate of 17.73 percent: 4.52 percentage points lower than  $t_m$ , the highest tax rate that is consistent with truth revelation. For  $t > t_m$ , the net revenue is negative. This is similar to being in the IAC regime, and the optimal choice for the government is to select  $\{p = 0, R = 0\}$ . Figure 4 shows the simulated outcome.<sup>7</sup>

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<sup>7</sup>We calculate the solutions for  $t$  giving the maximum revenue  $R^*$  using *MATHEMATICA*. Figure 4 was drawn using *TSP* in the following fashion. Use *TSP* to set  $f=0.2$ ,  $Nc=200$ , and  $y=1000$ . Now generate  $t$  from 0.01 to 1.00. First generate  $k = \exp(3t)-1$ . Now plug that into  $p^*$  (from 3.1). See the sample point where  $p^*$  moves from less than 1 to the nearest number greater than 1. This is the truncated sample for  $R^*(p^* \leq 1)$ . Now generate  $R^* = ty - p^*Nc$  for that truncated sample. That will give the left side of figure 4. Suppose  $p^*$  was less than 1 up to a sample point of 30. Now for sample 31 onwards, check the value of  $R = (1-k)(t+f)Y - Nc$  where we already have the values of  $k$ . [Note we are already in LAC, which is why  $R = p[(1-k)(t+f)Y - Nc] = (1-k)(t+f)Y - Nc$  (since  $p=1$ )]. If this  $R$  is always negative, as it will be, then  $k = \exp(3t)-1$  effectively transforms the economy to the IAC regime where we choose  $p^*$  if  $p^* \leq 1$ , and zero otherwise. With  $p=0$ ,  $R=0$ , which is why the right side of figure 4 has revenue going along the horizontal axis.

**Figure 4**  
**Revenue With Endogenous Corruption**



$$k = \min\{\exp(3t)-1, 1\}; f = 0; Y = 1000; Nc = 200$$

In the general case, when the economy is in LAC and the tax rate is raised beyond the point where  $p^*$  is feasible, the optimal strategy is to choose  $p = 1$ . Here

$$(14) \quad \left(\frac{\partial R}{\partial t}\right)_{k=k(t,f)} \geq 0 \text{ as } k_t \leq \frac{1-k}{t+f}$$

If  $k_t$  and  $k_{tt}$  are positive, it is possible to get an inverted U-shaped revenue function in the cheating phase. However, for identical  $f$ ,  $Y$ , and  $Nc$ , the same corruption function cannot generate two inverted U-shaped revenue functions -- one for  $p^* \leq 1$ , and the other in the cheating phase. If  $R^*$  is positive but rises and then falls (in the feasible  $p^*$  zone), then  $R$  is always negative for tax rates where  $p^* > 1$ . On the other hand, if  $R$  rises and falls (but remains positive) for some tax rates in the cheating phase, then  $R^*$  will be unambiguously increasing in  $t$  in the zone where  $p^* \leq 1$ .

Thus, making corruption endogenous in a simple way reverses the outcome of raising tax rates predicted by the basic model.

## 5. Conclusions

We should point out here that there is some difference between the cases discussed here and the Laffer propositions as generally understood. The Laffer conjecture is almost inevitably discussed in a general equilibrium framework. A better post tax earning rate is postulated to work as an incentive to factor supply and increases the level of production and taxable income following tax cuts. In the models discussed in our paper, the outcome stems from redistribution of income among tax payers, auditors and the government, at a *given* aggregate income level. This redistribution may or may not have feedback on the incentive to earn, and the final impact on aggregate income and revenue has not been addressed here.

While our analysis suggests that in a corrupt tax environment it is possible to have a negative relation between tax rate and net revenue, the obvious question remains about the robustness of the conclusions in relation to alternative model specifications. First, risk neutrality is a convenient assumption, but not necessarily a realistic one across different audit probabilities, tax, and penalty rates. Under risk neutrality, taxpayer optimisation yields a corner solution -- the taxpayer either honestly reports all her earned income or reports none. While acceptable for modeling purposes, it is not an accurate description of taxpayer behavior. Second, we need to examine in greater detail the relative importance of ‘carrots’ *versus* ‘sticks’ in reducing corruption among the government’s auditors.<sup>8</sup> Third, in this paper the government does nothing to counteract corruption.<sup>9</sup> However, it is interesting in this context to mention that Chander and Wilde (1992), modelling super-auditing in a different model specification have reported a negative relation between tax rate and revenue in some conditions. The problem with modeling super-auditing is that there is no reason to believe that higher levels of the bureaucracy are less corrupt than lower levels. One would have to examine the effects of a hierarchy of super-audits, where everyone is potentially corrupt, and ask if a strategy can be found to eliminate corruption, and if that dominates a regime with corruption.<sup>10</sup> This is also the

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<sup>8</sup> Two recent works on the role of incentives in this context are Besley and McLaren (1993), and Mookherjee and P'Ng (1995).

<sup>9</sup> It may be argued, though, that in highly corrupt tax enforcement regimes (e.g., India) there are hardly any super-audits, and the probability of being super-audited is very low. If super-audited, the probability of being successfully prosecuted is small. So auditors assume (indeed, it is common knowledge) that there is no watchdog agency.

<sup>10</sup> For corrupt auditing hierarchies and bribe chains, see Gangopadhyay, Goswami, and Sanyal (1991), and Basu, Bhattacharya, and Mishra (1992).

reason why we leave out possible super-audits from our discussion. Finally, models such as these need to be empirically tested using panel data.<sup>11</sup>

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<sup>11</sup> For the United States, empirical work on evasion has been carried out by Dubin, Graetz and Wilde (1987), Dubin and Wilde (1988), Mookherjee and P'Ng (1990), and Witte and Woodbury (1985). Of course, these models assume an honest IRS.

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