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Working Paper

Corruption, Tax Evasion and the Laffer Curve

Working Paper, No. 1996-04

Provided in Cooperation with:

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Suggested Citation: Gang, Ira N.; Sanyal, Amal; Goswami, Omkar (1998) : Corruption, Tax Evasion and the Laffer Curve, Working Paper, No. 1996-04, Rutgers University, Department of Economics, New Brunswick, NJ

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Corruption, Tax Evasion and the Laffer Curve

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Revised May 1998

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Abstract:

In a corrupt tax administration a rise in tax rate sets about complicated strategic moves by both taxpayers and administrators. It is shown that in some circumstances, this may bring about a Laffer like behavior of overall tax revenue, i.e. a higher tax rate results in smaller net revenue for the government. Further, a more intense tax effort by increasing the number of returns audited may also reduce net revenues. Finally if tax and fine rates positively influence the level of corruption in the administration, these outcomes become more likely.

The authors are grateful to Prakash Chander, Subhashis Gangopadhyay, Dilip Mookherjee, Paul Dalziel and seminar participants at the Public Choice Centre, George Mason University, for their comments.

Corruption, Tax Evasion and the Laffer Curve

1. Introduction

Literature on corruption in governance has been growing steadily for some time. Within this generic literature, different domains of corruption have been isolated for separate analysis, eg corruption in tax administration, in government purchases, in supervisory chains, in public allocation of credit or subsidized inputs as well as bribe taking in public services. While early theoretical literature focused more on developing modeling strategies and exploring the types of equilibria¹, more recently, the scope of the literature has widened significantly. For example, an illustrative list of issues, not entirely exhaustive, would include: the origins of bureaucratic corruption², corrupt hierarchies³, controlling corruption⁴, issues of political economy⁵ and aggregate implications of corrupt administration⁶. Our paper belongs to the last group in this list and the domain of corruption addressed is tax administration.

We explore the behavior of tax revenue net of collection costs in a regime of widespread administrative corruption. Specifically we examine the possibility of a 'Laffer curve' type of outcome in such a setting. Generally, the theoretical justification for a Laffer Curve outcome has been sought in increased factor supplies which result from the incentive of higher post-tax income per unit of supply [e.g. Minford and Ashton (1991)]. Here we examine the possibility from a different perspective. In a corrupt administration, variation of the tax rate leads to realignment of strategic decisions. For corrupt officials, a higher tax rate presents the possibility of a higher negotiated bribe rate for clearing under-disclosed returns. It may also increase the number of corrupt officials by overcoming implicit moral and psychological hurdles of erstwhile honest officials. Taxpayers on the other hand, respond by altering the

¹ This is not to suggest that development of modeling strategies has terminated. Recent examples include Bowles and Garoupa (1997) modeling police corruption, and Manion (1996) modelling bribing to get public service. Some examples of earlier literature are Lui (1986), Goswami, Sanyal and Gang (1991), Chander and Wilde (1992) modeling corrupt tax administration..

² See for example Thompsom and Thompson (1993), Banerjee (1997).

³ Some examples are Chander and Wilde (1992), Gangopadhyay, Goswami, and Sanyal (1991), Basu, Bhattacharya, and Mishra (1992), Bac (1996), Bac (1996a).

⁴ An early example is Klitgaard (1988). More recent work includes Besley and McLaren (1993), Rasmusen and Ramseyer (1994), Rauch (1995), Mookherjee and P'Ng (1995), Pommerehne and Weck-Hannemann (1996).

⁵ See for example Galeotti and Merlo (1994), Tullock (1996), Cheung (1996), Dawid and Feichtinger (1996), Bliss and Di Tella (1997), Bardhan (1997).

⁶ A sample of this literature: Asilis and Juan-Ramon (1994), Feichtinger and Wirl (1994), van de Morte and Cornelli (1994), Padersen (1995), Haque and Sahay (1996), Owoye and Bendardaf (1996), Liu (1996), Ades and Di Tella (1997).

amount of income disclosed. The tax revenue is taxes paid on voluntarily disclosed income plus what is hunted out by honest tax officials and the fine collected, while the enforcement cost determined by audit intensity is netted out from it. A Laffer outcome in this context is a situation where a cut in the tax rate leads to higher net revenue as the final outcome of the various strategic decisions involved⁷.

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 analyzed 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 made endogenous 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 Laffer outcomes in the context of two distinct models. In the first model, the proportion of corrupt auditors is exogenous, while in the second, the proportion is endogenously determined by tax and fine rates.

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

2. The Basic GSG Model

1. There are N taxpayers, each earning a true income Y_i but each declaring $Z_i \leq Y_i$. 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 period.

⁷ Clearly our use of the term 'Laffer' differs from its usual connotation. The Laffer outcome is normally discussed in a general equilibrium framework. A better post-tax earning rate is expected to increase factor supply, production and taxable income following tax cuts. In the models discussed in our paper, the outcome stems from redistribution of income among taxpayers, auditors and the government, at a *given* aggregate income level.

4. There is no wealth or bankruptcy. Hence, taxes and fines can, at most, drive a taxpayer's disposable income to zero.

5. Of the auditors, a proportion (k) are corrupt, while the remaining proportion ($1 - k$) are incorruptible. The basic model takes k as given, while in Section 4 we model 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.

(Figure 1 somewhere here)

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.⁸ Moreover, auditors do not make pre-commitments to accept lower bribes so as to induce more evasion; instead, they must bargain upon detecting evasion. The auditor's possible gain from a successful negotiation is the bribe itself, or $b(Y_i - Z_i)$. The taxpayer's possible 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 maximizes the product gains from negotiation.

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

A taxpayer will cheat if the expected gain 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

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

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

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

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

⁸ For some justification of this assumption see Klitgaard (1988)].

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.⁹

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

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

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

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

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

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 region.*

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 maximize 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 relative to tax rate.

- 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 maximizes 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 $p = \min(p^*, 1)$.

⁹ 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 were corrupt.

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.

Section 3: Varying the Tax Rate and the Possibility of a Laffer Outcome

3.1 The Laffer property of net revenue can be analyzed by examining the effect of tax rate variation on net revenue. We first state and establish a proposition that precludes Laffer-like outcome for an uncomplicated base scenario.

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.*

We begin by noting that as the tax rate rises, p^* rises, too, since from (3.1)

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

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

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

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

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, 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: $(\partial R / \partial t) = (1-k)Y > 0$. 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, Laffer outcomes become a possibility, as we discuss in the next two sections.

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 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.*

Figures 2.1 and 2.2 somewhere here.

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 analyzed by focusing on the LAC regime - the best-case scenario for the government. Suppose the 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 call them (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

$$(9) \quad \bar{t}Y - \bar{p}Nc > \bar{p}[(1-k)(\bar{t} + f)Y - Nc] \Rightarrow k > 1 - \frac{\bar{t}}{\bar{p}(\bar{t} + f)}.$$

Second, in a Laffer situation, it should be possible to obtain the revenue from any tax rate exceeding \bar{t} by levying some other 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 needed 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. Charging a tax rate less than \bar{t} can surpass the net revenue earned by levying any tax rate \bar{t} . In this situation it may be more cost effective to encourage truthful reporting at a lower tax rate than to cause cheating and then 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 somewhere here)

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, revenue falls immediately after \bar{t} , but because it keeps rising with t thereafter, eventually there is a region in the cheating zone where 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 somewhere here)

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 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 circumstances, the government can certainly do better by being Machiavellian - inducing cheating by raising taxes beyond \bar{t} , and then getting more revenue from tax and penalties. This is shown in Figure 3.3.

(Figure 3.3 somewhere here)

The three outcomes are closely related 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.¹⁰ 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, for example, 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 $\bar{t} =$

¹⁰ 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.

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.

Section 4: Endogenous Corruption and The Laffer Behavior

We now drop the assumption that the proportion of corrupt auditors is given. Instead we now make it dependent on tax and fine rates. Specifically, we assume $k = k(t, f)$, with $k_t > 0$, and $k_f > 0$.¹¹ 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 thus raising the k . 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, net revenue may fall with an increase in 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 t , 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.¹²

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,

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

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

¹¹ 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 optimizing decisions of the auditors.

¹² 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.

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

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

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.¹³

(Figure 4 somewhere here)

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

¹³ We have calculated 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 $p=0$, we have $R=0$, as in figure 4.

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.

Section 4: Conclusions

The general conclusion of our exercises is that in a corrupt regime there are a variety of situations where the government may suffer net revenue loss as an unanticipated outcome of intensified tax effort. Intensified effort may take the form of either wider auditing or higher tax rates or both. First, faced with large-scale evasion and collusion between tax-payers and officers, governments may react by increasing audit efforts. The resulting audit probability may very well be higher than optimal (see examples in section 3.3). This by itself, or together with further increase of tax rate, can produce smaller net revenue. Second, if the extent of corruption has a tendency to increase significantly with a rise in tax rate or fines, these latter instruments lose potency even if the government acts with optimal audit intensity.

An obvious question about these conclusions relates to their robustness with respect 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 optimization yields corner solutions -- 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's behavior.

Second, the conclusions may be sensitive to the institutional environment of the model. The government here does nothing to counter corruption. In reality governments try to take countervailing measures. A first set of measures is changing the remuneration scheme within the revenue administration: rewards for unearthing concealed income, and penalties for proven collusion. While some work has been done on the role and effect of incentives¹⁴, we can not examine their impact on net revenue here without radically altering the present model structure. Also, imposing penalty for proven collusion by tax officials needs a scheme of superauditing. While superauditing and audit hierarchies have been studied in some theoretical models¹⁵, a moot question is whether superauditing is at all effective in countries with

¹⁴ For example, Besley and McLaren (1993), and Mookherjee and P'Ng (1995).

¹⁵ See for example the works cited in footnote 3.

widespread corruption.¹⁶ It is however interesting in this context to mention that Chander and Wilde (1992), modeling 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 ones. One would have to examine the effects of a hierarchy of superaudits, where everyone is potentially corrupt, and ask if a strategy can be found to eliminate corruption, and if that strategy dominates net revenue collection in the regime with corruption.¹⁷ Finally, the models we have discussed in this paper need to be empirically tested using revenue data. Most of the empirical work done so far on tax evasion and net revenue assumes an honest tax administration¹⁸.

¹⁶ It may be argued that in highly corrupt enforcement regimes (e.g., India) 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.

¹⁷ For corrupt auditing hierarchies and bribe chains, see Gangopadhyay, Goswami, and Sanyal (1991), and Basu, Bhattacharya, and Mishra (1992).

¹⁸ 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. For India, see Das-Gupta and Gang (1998).

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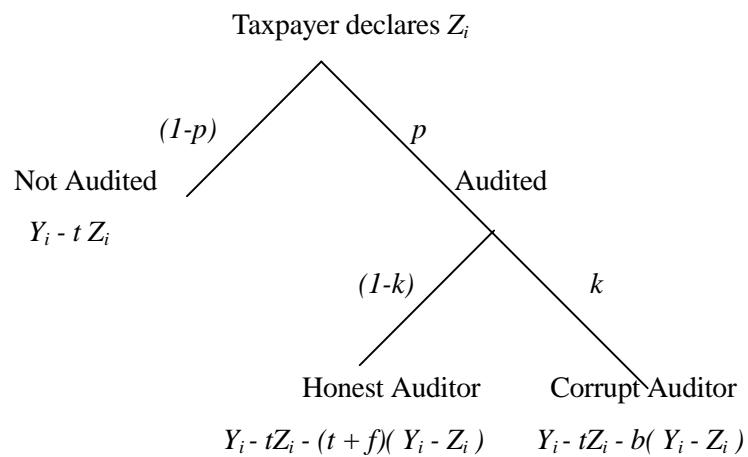


Figure 1: The Basic Model

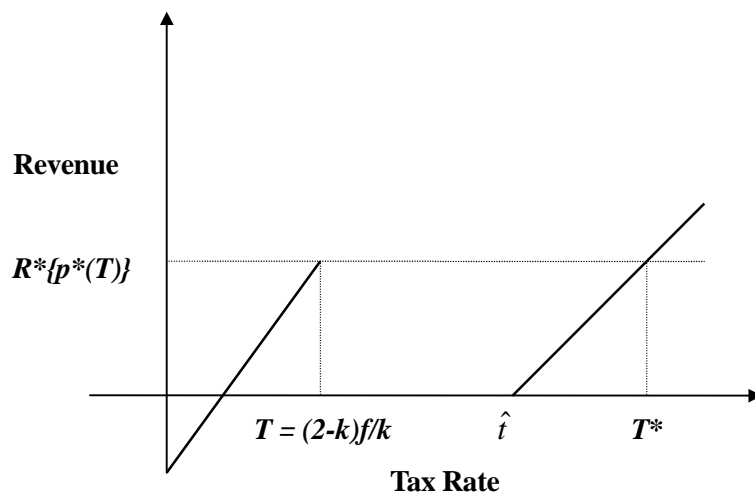


Figure 2.1

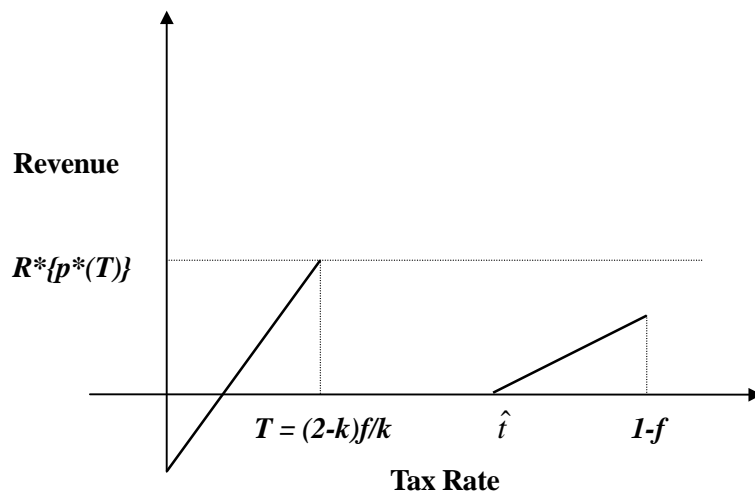


Figure 2.2

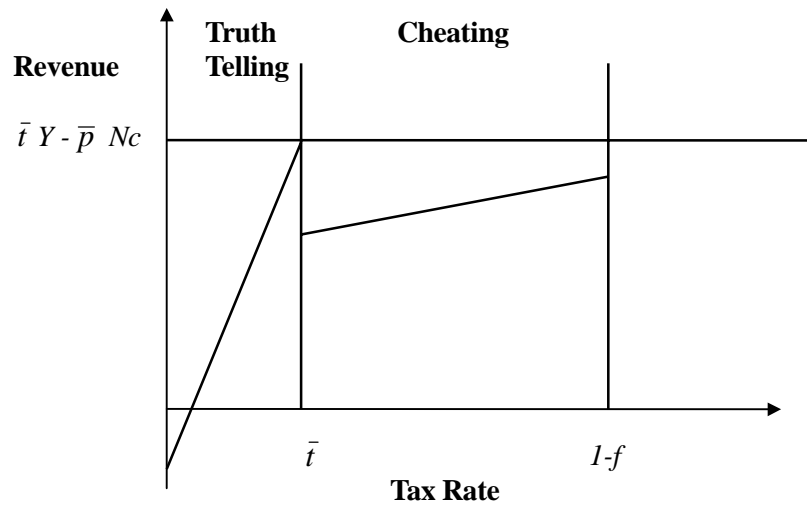


Figure 3.1: Strict Laffer

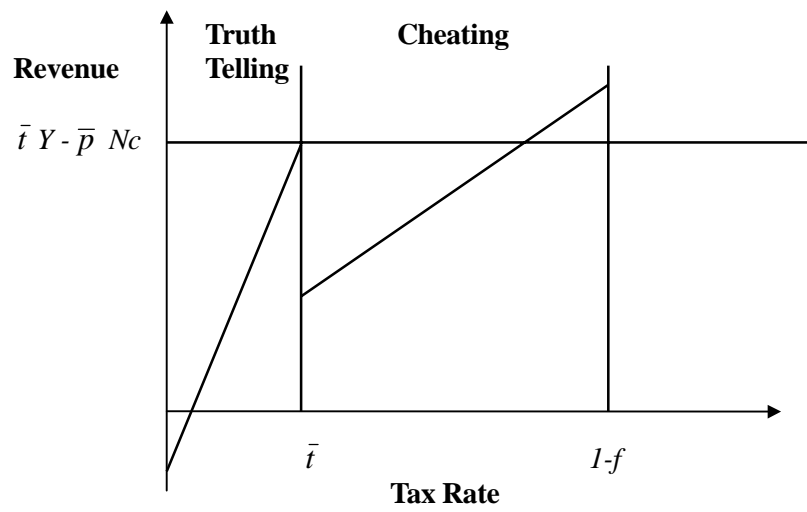


Figure 3.2: Weak Non-Laffer

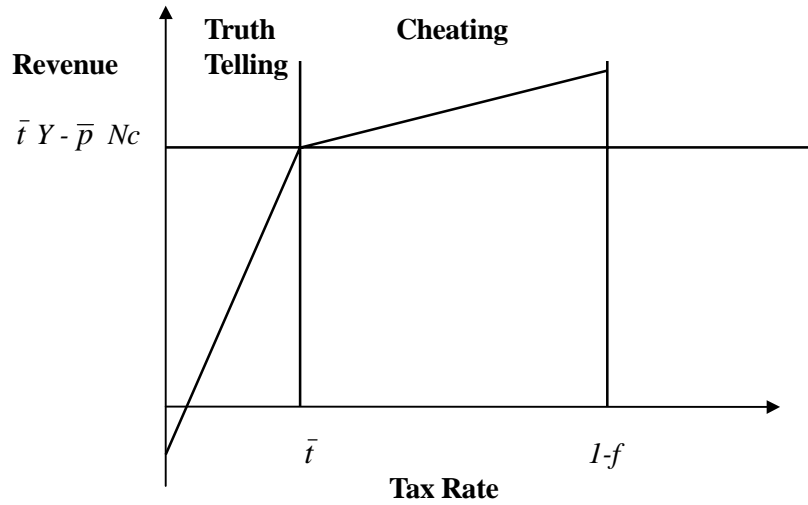


Figure 3.3: Strict Non-Laffer

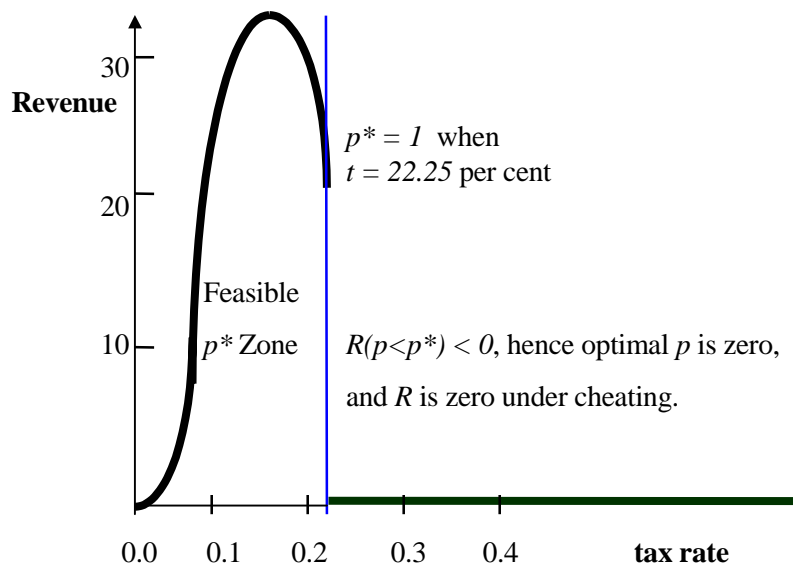


Figure 4: Revenue with endogenous corruption.

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