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# Evasion and Time Consistency in the Taxation of Capital Income

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**Discussion Paper #890**

**Evasion and Time Consistency in the  
Taxation of Capital Income**

by

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October 1993

# EVASION AND TIME CONSISTENCY IN THE TAXATION OF CAPITAL INCOME

Robin Boadway\* and Michael Keen†

October 1993

Abstract: Evasion and time inconsistency have been prominent concerns in recent discussions of capital income taxation, both theoretical and applied. This paper establishes a link between them, suggesting a potentially useful role for evasion additional to those previously identified: by committing to relatively lax enforcement, the government may be able to alleviate the welfare loss implied by its inability to commit to the tax rate. The scope for this role proves strikingly wide: it is optimal for the government to facilitate the evasion of the capital income taxes that it chooses to impose whenever the time consistent tax rate exceeds that which would be optimal if the government could commit to it.

JEL: H21, H26, H30

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## I. Introduction

It is well-known, from the work of Kydland and Prescott (1977), Fischer (1980) and others,<sup>1</sup> that there is potentially a time consistency problem in the taxation of capital income: when savings decisions have yet to be made, the optimising government will recognise the *ex ante* distortionary costs of a tax on savings; after they have been made, it will correctly perceive such a tax to be *ex post* lump sum. Thus a well-intentioned government may wish to renege on its announced capital income tax policy. The implications of this for our understanding of capital income taxation are potentially profound. The results of Chamley (1986) and Lucas (1990) on the optimality of a path of capital income tax rates which decline to zero, for example, depend critically on their assumption that the government can commit to future tax rates: the declining path reflects exactly the balance between the desire for a heavy tax on capital in place and the desire not to discourage unduly the formation of capital for the future that is the essence of the potential time inconsistency problem. Given the practical importance of the issues at stake — how should savings be taxed? — the problem deserves close attention. In particular, it is natural to look for devices by which governments might limit the welfare loss imposed by the requirement that their capital income tax policy be time consistent.<sup>2</sup> Reputation effects are an obvious candidate. Another is the use of ‘up-front’ investment subsidies, such as tax credits or tax holidays.<sup>3</sup> The purpose of this paper is to suggest and explore another possible way of ameliorating the time consistency problem in taxing capital income: by facilitating the evasion of such taxes.

A simple example provides a first suggestion that evasion might play a useful social purpose in this context. Consider the standard two-period representative agent analysis of the optimal balance between taxes on capital and labour income (as for instance in King (1980)), in which evasion is implicitly assumed impossible. Suppose that preferences happen to be such that a government which could commit to its tax policy would optimally set the rate of tax on capital income to zero.<sup>4</sup> If it cannot so commit, however, the private sector’s recognition of the *ex post* incentive it will face to impose a positive tax on savings is liable to force the government to charge a positive tax in the time consistent equilibrium. But now suppose, at the other extreme, that evasion is completely costless to the private sector. Then the government is simply unable to

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<sup>1</sup>Including, for example, Rogers (1987), Chari, Kehoe and Prescott (1989) and Persson and Tabellini (1990).

<sup>2</sup>As Fischer (1980) pointed out, since the optimal time consistent tax rate is in the feasible set when the government can commit, the time consistency constraint can only reduce attained welfare.

<sup>3</sup>Some authors have also pointed out that restricting the types of tax instruments the government can use may be welfare-improving in the face of time inconsistency, even if otherwise superior taxes are ruled out. Thus, Rogers (1987) shows that it may be preferable to restrict governments to using wage taxes rather than consumption taxes and Bruce (1990) argues that indirect taxes may be preferable to direct ones.

<sup>4</sup>King (1980) shows that this will be the case if first and second period consumption are equally substitutable for leisure (assuming, in his overlapping generations framework, that debt can be used to adjust the aggregate capital stock).

tax savings *ex post*, and a zero rate of capital income taxation consequently becomes credible. Even though it is still unable to commit to the tax rate directly, evasion thus enables the government to do so indirectly and hence to implement exactly the same (welfare-superior) tax policy that it would if it could commit.<sup>5</sup> While this example is clearly an extremely special one — exempting capital income from tax is generally not optimal when the government can commit — it is enough to suggest potential scope for strategic considerations in the design of tax ‘enforcement’ policies. Our purpose is to pursue such considerations when there is not such a fortuitous coincidence between the outcomes with perfect commitment and with ubiquitous evasion. The hypothesis of interest is simply put: Might an optimal response to an inability to commit to the rate at which capital income is taxed be to facilitate the evasion of that tax?

What makes the question an interesting one in practical terms is the observation that governments often seem to find it easier to change statutory tax rates than to change the effectiveness with which they are enforced (as has long been emphasised, for instance, by those working on tax policy in developing countries). Tax rate reform is a matter of legislation. And while legislative branches may sometimes move slowly, fundamental reform of executive practices is liable to take even longer. In particular, the effectiveness with which taxes are enforced today depends very largely on past investments in the training of tax officials and the educating of taxpayers, past efforts in the identification of potential taxpayers, past decisions on reporting requirements, and so on. By the same token, decisions taken on such matters today constrain the effectiveness of tax administration in the future. They thus become devices by which the government can commit to the ease of tax evasion.

The potential scope for committing to the ease of evasion is especially evident in the area of international taxation. Investing abroad and failing to declare the return to the domestic authorities is a time-honoured evasion device. Discouraging such behaviour requires, for instance, the negotiation of tax treaties providing for cooperation between national tax authorities and the establishment of effective mechanisms for information-sharing between them; aspects of tax administration that cannot be changed at short notice. While the model developed below is of a closed economy, it is in this area of international taxation and cooperation that the issues which the analysis raises may have their most direct relevance to current policy concerns. For as capital has become more mobile internationally, so the evasion of taxes on capital income has come to be perceived as an increasingly serious problem.<sup>6</sup> In Europe, in particular,

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<sup>5</sup>That evasion may have a useful role to play in alleviating the commitment problem is also suggested by the results of Kehoe (1989), who shows that a situation in which international tax competition drives source-based taxes on capital income to zero may be welfare-superior to one in which a single common tax rate is set by a central authority (and the possibility of capital flight thus removed).

<sup>6</sup>Giovannini (1988) and Schjelderup (1992) analyse aspects of capital income tax evasion in an international context, but not the potential link with commitment problems with which we are concerned. Both examine the optimal tax policy for a small open economy that is able to commit

the question has been raised as to whether — as a consequence of a potent combination of evasion and tax competition — capital income taxes can even survive (a question addressed, for example, by Gordon (1992)). The arguments developed here put a different gloss on these concerns. It may not be so obvious as it seems that evasion and the administrative imperfections which facilitate it — incomplete information-sharing, bank secrecy laws and the like — are to be lamented unreservedly as undermining the integrity of capital income taxes. On the contrary, they may serve a valuable role in promoting their efficiency.<sup>7</sup>

There is of course a large and growing literature on tax evasion (though not, for the most part, in relation to capital income taxes), which has identified a number of circumstances in which it would not be optimal to enforce taxes perfectly even if it were costless to do so. In many-person economies, permitting evasion may enable a weakening of the self-selection constraints on non-linear tax design: see for example the discussion in Stiglitz (1982) of randomising tax rates, to which evasion bears many similarities. And Weiss (1976) shows — in the atemporal context of taxing labour income — that some evasion may be optimal even in the single-person setting (some intuition for this being given below). The potential social role of evasion being examined here, however, is distinct from those found in the extant literature, which has not addressed the relationship between evasion and commitment. To abstract from self-selection effects, we consider (effectively) a single-person economy. The Weiss effect is harder to remove. It will recur in the present context, with the result that some evasion of capital income taxes may be optimal even when the government can commit to the tax rate. This is of some interest in itself, but calls for care in formulating the question that is our central concern: the issue is not simply whether some evasion is optimal when the government cannot commit to the rate of capital income taxation, but whether such an inability to commit provides a qualitatively distinct argument for permitting evasion.

The plan of the paper is as follows. Section II describes the model, which includes a simple technology (parameterised by the probability of detection  $p$ ) for the evasion of the capital income tax (levied at rate  $\tau$ ). Section III then looks at the optimal tax problem when the government can commit to both  $\tau$  and  $p$ ; we refer to this as the *full commitment* case. Sections IV and V then formulate and examine the government's

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to the tax rate, able to tax domestic investments, but unable to tax residents' investments abroad. Schjelderup also analyses optimal enforcement policy (in what corresponds to the 'full commitment' case below); Giovannini briefly considers the implications of an inability to commit to the tax rate, but does not raise the potentially beneficial effects of evasion, and the consequent scope for its strategic manipulation, that are the central concerns here.

<sup>7</sup>Bacchetta and Espinosa (1992) examine strategic aspects of information-sharing between national tax authorities in its natural game-theoretic setting. They find that full sharing may be Pareto inefficient if there are irremovable tax distortions (such as imperfect crediting). There being no commitment problem in that analysis, this argument for imperfect enforcement is distinct from that pursued here. Note, however, that in a deeper sense both arguments derive from a common cause: the government's assumed inability to deploy lump sum taxes.

optimisation problem when — the *partial commitment* case — it cannot commit to  $\tau$  (and so faces a time consistency problem) but can commit to  $p$ . The central concern is with the comparison of the optimal degrees of evasion in the two cases, the question being whether moving from full to partial commitment case generates a distinct social purpose for tax evasion. Section VI concludes.

## II. The Model

The economy is inhabited by a large number of identical individuals. Each has preferences represented by a von Neumann-Morgenstern utility function that is additively separable over consumption in periods 1 and 2 ( $X_1$  and  $X_2$ ) and the level  $G$  of some public good that for simplicity is provided only in period 2:

$$U_1(X_1) + U_2(X_2) + \mu(G). \quad (1)$$

It is assumed throughout that  $U_1(\cdot)$ ,  $U_2(\cdot)$  and  $\mu(\cdot)$  are increasing and strictly concave;  $U_2$  and  $\mu$  are further assumed to satisfy an Inada condition that ensures that both savings and public expenditure will be strictly positive in the equilibria with which we shall be concerned. Each individual is endowed with an amount  $e > 0$  of period 1 consumption; the amount  $S$  of this that they choose to save is their only source of period 2 consumption. (For simplicity, there is assumed to be no labour supply decision). The one-period pre-tax return on saving  $r$  is assumed to be strictly positive and taken as constant throughout.

Capital income  $rS$  is taxed at the rate  $\tau$ . There is, however, a possibility of evading this tax. This is modelled as simply as possible, along the lines of Allingham and Sandmo (1972). Individuals choose the proportion  $\theta$  of their capital income that they report to the authorities. If lucky, they are not audited, and so pay tax only on the income that was reported. In this event their period 2 consumption  $N$  (for ‘not caught’) is:

$$N = (1 + r_N)S \quad (2)$$

where  $r_N = (1 - \tau\theta)r$ . But evaders run the risk of being audited. If they are, the exact amount of their capital income becomes known for certain to the authorities. Tax is then payable on the whole amount and, in addition, a fine at rate  $f$  is levied<sup>8</sup> on the

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<sup>8</sup>The fine is taken to be exogenous throughout. We conjecture that endogenising  $f$  would affect the substance of the results below only if the government were unable to commit to it, so that full compliance could be enforced *ex post* by setting  $f$  sufficiently high. If the government could commit to  $f$ , its role will be qualitatively similar to that played by  $p$  in what follows. Arbitrarily assuming the fine to be fixed at some finite level is common practice in principal-agent analysis, one possible



undeclared income of  $(1 - \theta)rS$ . In this case, period 2 consumption  $C$  (for ‘caught evading’) is thus:

$$C = (1 + r_C)S \quad (3)$$

where  $r_C = (1 - \tau - f(1 - \theta))r$ . The probability of being audited — assumed to be public knowledge, and to be perceived by the individual as independent of any of her actions — is denoted by  $p$ .

Combining these ingredients, the problem of the representative consumer is to choose  $S$  and  $\theta$  to maximise expected lifetime utility, given by:

$$V(S, \theta; \tau, p, G) = U_1(e - S) + pU_2(C) + (1 - p)U_2(N) + \mu(G) \quad (4)$$

In this optimisation the consumer takes as given the  $\tau$  and  $p$  announced by the government at the start of period 1; and in the two equilibria that we shall principally be concerned with the government will adhere to those announcements. The first-order conditions are:<sup>9</sup>

$$\begin{aligned} V_S(S, \theta; \tau, p, G) &= -U_1'(e - S) + pU_2'(C)(1 + r_C) + (1 - p)U_2'(N)(1 + r_N) = 0 \quad (5) \\ V_\theta(S, \theta; \tau, p, G) &= \{pU_2'(C)f - (1 - p)U_2'(N)\tau\} rS \geq 0 \quad (6) \end{aligned}$$

In (5), the consumer compares in a familiar way the marginal utility forgone in saving more today with the expected marginal utility of the additional consumption this buys tomorrow. In (6), she compares the potential penalty on concealing an additional unit of capital income with the potential benefit of a reduced tax bill. Solving (5) and (6) gives the savings and reporting functions<sup>10</sup>  $S(p, \tau)$  and  $\theta(p, \tau)$ .

Substituting these solutions for  $S$  and  $\theta$  back into  $V(\cdot)$  gives the indirect utility function:

$$W(p, \tau, G) = V[S(p, \tau), \theta(p, \tau); \tau, p, G] \quad (7)$$

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rationale being that in richer models an upper bound may be imposed on  $f$  by costs associated with incorrectly fining non-delinquents. Some of the consequences of the authorities not being able to commit to  $f$  are investigated in Boadway *et al* (1993), though theirs is a model of criminal behaviour in which  $f$  is determined by judicial discretion rather than by legislation.

<sup>9</sup>Derivatives are denoted by subscripts for functions of several variables and by a prime for functions of just one. We ignore the possibility of a solution with  $\theta = 0$ . As is natural, we assume the penalty does not treat over-reporting symmetrically with under-reporting: that is,  $f=0$  if  $\theta > 1$ . See Cowell (1990) for a detailed discussion of the reporting decision in a similar model.

<sup>10</sup>Separability of direct utility in  $G$  implies that the consumer’s behaviour is unaffected by the level of public good provision.

with derivatives

$$W_\tau = V_\tau = -rS \{pU'_2(C) + (1-p)U'_2(N)\theta\} < 0 \quad (8)$$

$$W_p = V_p = U_2(C) - U_2(N) \leq 0 \quad (9)$$

$$W_G = \mu'(G) > 0 \quad , \quad (10)$$

the equality applying in (9) if  $\theta = 1$ .

The case in which  $\theta(p, \tau) = 1$ , so that consumers choose to report all their income, will be of particular importance below. From (6), there will be no evasion iff  $pf \geq (1-p)\tau$ . The dividing line between evasion and truthful reporting is defined by the set of  $\tau$  and  $p$  such that  $pf = (1-p)\tau$ . In such circumstances, which for brevity we refer to as the *borderline* case, the expected monetary return to evasion is zero: the expected fine on concealing one more unit of income,  $pf$ , equals the expected tax saving,  $(1-p)\tau$ . The risk-averse consumer will then choose to conceal no income, but will be just on the verge of doing so; a small reduction in the probability of detection, or a small increase in the tax rate, will turn evasion into a better-than-fair bet, and so turn the consumer into an evader. For later reference, note that at the borderline:

$$pf = (1-p)\tau \quad ; \quad \theta = 1 \quad ; \quad C = N \equiv \bar{C} \quad ; \quad r_C = r_N = (1-\tau)r \equiv \bar{r} \quad . \quad (11)$$

The effects of the government's choice variables  $\tau$  and  $p$  on the private sector's savings and reporting decisions follow from routine comparative statics on (5) and (6). In general, the results are complex and of little interest. At the borderline, however, sharp results are obtained that will prove helpful below.<sup>11</sup> For savings, one finds:

$$S_\tau(p, \tau) = \frac{\{1 - \sigma_2(\bar{C})\} r U'_2(\bar{C})}{U''_1(e - S) + U''_2(\bar{C})(1 + \bar{r})^2} \quad (12)$$

$$S_p(p, \tau) = 0 \quad (13)$$

where  $\sigma_2(X_2) = -U''_2(X_2)X_2/U'_2(X_2)$ . The effect of taxation on saving is thus ambiguous, as one would expect: an increase in the tax rate reduces savings iff  $\sigma_2$ , the elasticity of the marginal utility of consumption in period 2 (equivalently, the coefficient of relative risk aversion in period 2, or the reciprocal of the intertemporal elasticity of substitution), is less than unity. The result in (13) is more striking, and plays a key role below: for a consumer at the borderline of evading, a small reduction in  $p$  has no effect on savings. The reason is simple: for a non-evader a small reduction

<sup>11</sup>Details of the derivation of (12)–(15) are sketched in Appendix A.

in the probability of detection has no impact effect on the marginal return to saving, there being nothing for the authorities to detect. For the reporting function one has:<sup>12</sup>

$$\theta_{\tau}(p, \tau) = \frac{-(1 + \bar{r})}{(f + \tau)\tau r \sigma_2(\bar{C})} < 0 \quad (14)$$

$$\theta_p(p, \tau) = -\left(\frac{f + \tau}{1 - p}\right) \theta_{\tau}(p, \tau) > 0, \quad (15)$$

which are as one would expect from the discussion above.

In the absence of aggregate uncertainty — there being a large number of individuals identical to the one just considered — and normalising the population size at unity, the government collects revenue in period 2 (only) of:

$$R(\tau, p) = rS(\tau, p)\{\tau\theta(\tau, p) + p(\tau + f)(1 - \theta(\tau, p))\}, \quad (16)$$

the first term being the tax collected on reported incomes, the second the tax plus penalty that a proportion  $p$  of taxpayers pay on the income they tried to conceal. The price of the public good provided by the government is assumed constant throughout, and normalised at unity. The level of provision is thus given by  $G = R$ . Note that — to preclude one obvious reason for the existence of evasion at an optimum — auditing and penalising are assumed entirely costless to the authorities.

### III. Optimal Taxation and Evasion with Full Commitment

Here we examine, as a benchmark, the case in which the government can commit not only to the probability of detection  $p$  — which we assume to be the case throughout — but also to the tax rate  $\tau$ .<sup>13</sup> Substituting from the revenue constraint, the government's problem is then to:

$$\max_{p, \tau} W(p, \tau, R(p, \tau)) \quad (17)$$

Combining the two first-order conditions for (17) one finds that, at an interior solution:

<sup>12</sup>Since evaluation is at  $\theta = 1$ , these are right- and left-hand derivatives respectively.

<sup>13</sup>Reinganum and Wilde (1985, 1986) and Graetz, Reinganum and Wilde (1986) investigate time-consistent audit policies when audit effort, and therefore the probability of detection, can be chosen after taxpayers have filed their tax returns. Since their concern is not with tax policy, they take the tax rate as fixed.

$$\frac{W_p}{W_\tau} = \frac{R_p}{R_\tau} \quad (18)$$

This has a useful diagrammatic interpretation. The left-hand side of (18) is the consumer's marginal rate of substitution of  $\tau$  for  $p$ , at constant  $G$ ; (minus) the slope, that is, of an indifference curve in  $(p, \tau)$ -space. Similarly, the right-hand side is (minus) the slope of an iso-revenue contour. From (8) and (9), the former is given by

$$-\frac{W_p}{W_\tau} = \frac{U_2(C) - U_2(N)}{rS\{pU_2'(C) + (1-p)U_2'(N)\theta\}} \leq 0 \quad (19)$$

while, differentiating (16), the latter is

$$-\frac{R_p}{R_\tau} = - \left( \frac{S_p\{\tau\theta + p(\tau + f)(1 - \theta)\} + S\{(\tau + f)(1 - \theta) + ((1 - p)\tau - pf)\theta_p\}}{S_\tau\{\tau\theta + p(\tau + f)(1 - \theta)\} + S\{\theta + p(1 - \theta) + ((1 - p)\tau - pf)\theta_\tau\}} \right) \quad (20)$$

Substituting (19) and (20) into (18) gives a cumbersome marginal condition that need not detain us. More important for present purposes is the observation — which follows from using the elements of (11) in (19) and (20) — that, at the borderline,

$$\frac{W_p}{W_\tau} = 0 = \frac{R_p}{R_\tau} \quad (21)$$

As illustrated in Figure 1, indifference and iso-revenue curves are thus both horizontal at the borderline. As a consequence, if the first-order conditions for the full commitment problem have a solution — which we assume they do — then they have a solution in which there is no evasion.

Put another way, (21) implies that there is no first-order gain from allowing a little tax evasion. The intuition for this follows from the feature that the indifference and iso-revenue contours are not merely tangential at the borderline, but then have a common slope of zero. That welfare is unaffected (at constant  $G$ ) by a small reduction in  $p$  at the borderline is clear enough: envelope considerations mean that the gain to the consumer from a reduction in  $p$  is simply the utility gain from not being caught (recall (9)); and this, when one is not evading, is zero. What is less obvious, and in that sense drives the result, is that revenue will also be unaffected. Here there are three effects to consider, all of which turn out to vanish at the borderline. The direct effect of changing  $p$  in (16) is clearly zero, since no revenue is gained from catching evaders when no one evades. The second is the effect on  $\theta$ : reducing  $p$  will induce some under-reporting (recall (15)). But since the expected monetary gain to the taxpayer from evasion is negligible at the borderline, so too is its revenue cost to the government.

The third is the effect of laxer enforcement on the level of savings. But this — by (13) and the reasoning given there — is also zero.

The existence of a solution to the first-order conditions in which there is no evasion does not imply that there is no evasion at an optimum. For that one must look to the relative curvature of indifference and iso-revenue curves.<sup>14</sup> And here, as the complexity of (19) and (20) suggest, there are few general conclusions: we have been unable, for instance, to establish convexity/concavity of either curve throughout its range. It is shown in Appendix B, however, that<sup>15</sup> the relative curvature at the borderline is as illustrated in Figure 1 — which implies, bearing in mind the directions of increasing welfare and revenue shown, that the borderline point  $\alpha$  is at least a local optimum — iff, at such a point:

$$U_2''' < \frac{(U_2'')^2}{U_2'} - \frac{U_2''}{\bar{C}} + \left( \frac{U_2''(U_1'' + \bar{C}U_2'')}{U_2'(1 + \bar{r})r\tau} \right) \quad (22)$$

If on the other hand this condition fails, then some evasion of capital income taxes will be optimal. The result parallels that of Weiss (1976) for taxes on labour income mentioned in the Introduction,<sup>16</sup> and can be given a simple explanation. Since deadweight loss is convex in the tax rate, randomisation (to which evasion is akin) raises the expected deadweight loss from a given expected tax rate; but if revenue is sufficiently convex, randomisation may also enable a reduction in the average tax rate that more than offsets this welfare loss. Negating (22) shows that this will indeed be the case if the third derivative  $U_2'''$  is a sufficiently large positive number; or, equivalently, if prudence<sup>17</sup> is sufficiently high.

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<sup>14</sup>Strictly, the sufficient conditions for a local optimum involve more than the relative curvature of these loci: they also require that  $\mu(G)$  be sufficiently concave. To see this, note first that the second-order conditions for problem (17) require the strict concavity of  $W(\cdot)$  in  $p$  and  $\tau$ , which the curvature properties are not enough to guarantee. The additive separability of individual utility allows us to restate the second-order conditions in the following way. Define  $w(p, \tau) + \mu(G) \equiv W(\cdot)$ . Then the government's problem can be seen as a two-stage one. In the first stage, the government chooses  $p, \tau$  to maximize  $w(p, \tau)$  subject to  $R(p, \tau) = G$  where  $G$  is taken as given. The solution to this problem is an indirect utility of consumption function  $\omega(G)$  such that  $\omega(G) < 0$ . The second-order conditions for this problem are simply the relative curvature conditions discussed in the text below. In the second stage the government chooses  $G$  to maximize  $\mu(G) + \omega(G)$ , the second-order condition for which is  $\mu''(G) + \omega''(G) < 0$ . We assume in what follows that  $\mu(G)$  is sufficiently concave to satisfy this second-order condition. If so, the relative curvature condition illustrated in Figure 1 will be sufficient to obtain a local optimum.

<sup>15</sup>The argument assumes  $R_\tau > 0$ , so the government is on the 'right' side of the Laffer curve; which, at an optimum, it must be.

<sup>16</sup>The slight differences between (22) and (19) of Weiss (1976) (there appears to be typographical error in (12)) reflect our separability assumption in (1) and the structural differences between a tax on labour income (all consumption then being taxed, in the absence of evasion) and one on capital income (only that part of second period consumption financed by interest taxable).

<sup>17</sup>See, for instance, Blanchard and Mankiw (1988).

The possibility that some evasion of capital income taxes will be optimal in the full commitment case is an interesting one. But it is something of a distraction in terms of our central concern, which is to explore whether evasion might serve a very different social purpose as a response to the time consistency problem. To articulate this concern as sharply as possible, we shall therefore suppose (22) to be satisfied. This is a relatively mild restriction, the conventional assumption (following Arrow (1971)) of non-decreasing relative risk aversion being sufficient: for then  $U_2''' \leq ((U_2'')^2/U_2') - (U_2''/\bar{C})$ , and so, by concavity of  $U_1$  and  $U_2$ , (22) must hold.

Thus we take as our benchmark result:

**PROPOSITION 1:** *If the government can commit to the tax rate and (22) holds, then there exists a local optimum in which evasion is zero.*

The question now is whether this continues to be the case when it cannot so commit.

#### IV. The Partial Commitment Equilibrium

Suppose then that whilst the government can commit to the probability of detecting evaders it cannot commit to the tax rate. More precisely, we now assume that while  $p$  is irrevocably fixed before the private sector makes any of its decisions,  $\tau$  is determined only after  $S$  has been decided (but before  $\theta$  has been). If there were no evasion, the tax base perceived in period 2 would thus be perfectly inelastic.<sup>18</sup> There would then be no efficiency loss in taxing capital income. With evasion, however, that will not be true. The tax rate will affect evasion decisions and hence the tax base, effects that the optimising government must take into account in designing the tax structure. The question is whether it is optimal to induce such *ex post* elasticity of the tax base by committing to less than perfect enforcement.

The government's optimisation problem now falls into two stages, and is solved by backward induction in a familiar way. The second stage is the selection of the tax rate. Taking as given period 1 decisions — the consumer's choice of  $S$  and its own choice of  $p$  — the government's problem is then to choose  $\tau$  to maximise:

$$\Omega(\tau; S, p) \equiv pU_2(C) + (1 - p)U_2(N) + \mu(\tilde{R}(\tau, p)) \quad (23)$$

where

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<sup>18</sup>The same would be true even in the presence of evasion if the proportion of income declared to the authorities were also chosen before the announcement of  $\tau$ . But the present supposition that reporting decisions are taken in the knowledge of the applicable tax rate seems more natural.

$$\tilde{R}(\tau; S, p) = rS\{\tau\theta(p, \tau) + p(\tau + f)(1 - \theta(p, \tau))\} \quad (24)$$

differs from the revenue function  $R(\tau, p)$  of (16) in that  $S$  is taken as pre-determined.

Using (6), the first-order condition for this problem can be written as:

$$\Omega_\tau/rS = -\{pU'_2(C) + (1-p)U'_2(N)\theta\} + \mu'(G)\{\theta + p(1-\theta) + ((1-p)\tau - pf)\theta_\tau\} = 0, \quad (25)$$

which we assume can be solved to give

$$\tau = \phi(p, S), \quad (26)$$

relating the *ex post* optimal tax rate to the predetermined variables  $p$  and  $S$ .

The first stage of the government's problem is the period 1 choice of  $p$ . In this it will recognise the implications for the *ex post* optimal tax rate, described by (26). The question then arises as to how the private sector forms its view as to the tax rate that will be implemented. Rather than allow the private sector to be fooled by the government, we consider only time consistent equilibria: ones in which the announced tax rate will prove *ex post* optimal. Recognising this imposes on the government the constraint that:

$$\tau = \phi(p, S(p, \tau)). \quad (27)$$

That is, the tax rate announced must be credible in the sense that it will indeed prove *ex post* optimal when savings decisions are based upon it. Solving (27) gives the equilibrium tax rate as a function  $\tilde{\tau}(p)$  of the probability of detection. The properties of  $\tilde{\tau}$  will prove important, and are discussed later. For the moment, we simply assume that such an equilibrium exists and satisfies the stability condition:<sup>19</sup>

$$1 > \phi_S S_\tau. \quad (28)$$

Substituting the function  $\tilde{\tau}(p)$  into the indirect utility function (7) and the revenue function (16) gives lifetime expected utility as a function of  $p$  alone:

$$\tilde{W}(p) = W(p, \tilde{\tau}(p), R(p, \tilde{\tau}(p))), \quad (29)$$

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<sup>19</sup>The stability is that of a process in which, at each iteration, the tax rate is set *ex post* optimally conditionally on the savings induced by the tax rate of the previous round; that is, in obvious notation,  $\tau_t = \phi(p, S(p, \tau_{t-1}))$ .

where the effects of the tax rate on the level of savings now implicitly enter the calculation through  $\tilde{\tau}(p)$ . The first stage of the optimisation is thus to maximise  $\bar{W}(p)$  with respect to  $p$ , and it is to this that we turn in the next section.

Before doing so, however, it is instructive to consider the precise nature of the time consistency problem in this model. Suppose then that the government has an opportunity to reoptimise with respect to the tax rate at the beginning of period 2, having previously announced as policies the solution values for a full commitment local optimum of the kind in Proposition 1, and having been believed. Denoting these solution values by asterisks, evaluating  $\Omega_\tau$  at the full commitment borderline optimum yields:

$$\Omega_\tau(\tau^*; S^*, p^*) = -rS^* \{U'_2(\bar{C}^*) - \mu'(G^*)\} . \quad (30)$$

The first-order condition  $W_\tau = -\mu'R_\tau$  for the full commitment borderline optimum implies, using (8) and  $R_\tau$  from (16), that:

$$U'_2(\bar{C}^*) = \mu'(G^*) \left(1 + \frac{\tau^* S^*_\tau}{S^*}\right) \quad (31)$$

so that (30) can be written as:

$$\Omega_\tau(\tau^*; S^*, p^*) = -\mu'(G^*) r \tau^* S^*_\tau . \quad (32)$$

So long as savings are not completely unresponsive to the post-tax rate of return (and hence to  $\tau$ ) a government which announced the full commitment optimal tax rate — and was believed — would thus like to renege on its announcement *ex post*. The conventional presumption in this area is that it would wish to renege in the direction of setting a higher capital income tax rate than announced. In models with the possibility of taxing variable labour income, and at least for convenient special cases, this has indeed been shown to be the case: see for instance Persson and Tabellini (1990). In the present context, however, renegeing could be in either direction.<sup>20</sup> For suppose that savings increase with the tax rate. Intuitively, the attractions of widening the inelastic period 2 tax base then give the government an incentive to announce a tax rate that is actually higher than it plans to implement.<sup>21</sup>

No restriction is placed on the sign of  $S_\tau$  in what follows. We do though take the case in which  $S_\tau < 0$  to be of particular importance, not because it is necessarily the most

<sup>20</sup>Interestingly, this also emerges from the simulations reported in Table 2 of Rogers (1987).

<sup>21</sup>One direct way in which to interpret this observation that the incentive to renege can go either way is by comparing the marginal social cost of public funds (MSCPF) — the quantity to which the ratio of the marginal benefit of public expenditures to the marginal utility of private consumption is optimally equated — in the full commitment case with that when the government can renege. From (31) one finds that in the full commitment case (omitting the asterisks):



plausible in terms of the internal structure<sup>22</sup> of the model but rather because it captures the conventional presumption that time inconsistency induces heavier taxation of capital income than would otherwise be the case.

## V. The Optimality of Evasion in the Partial Commitment Case

Differentiating the maximum value function  $\widetilde{W}(p)$  in (29) gives

$$\begin{aligned}\widetilde{W}'(p) &= W_p + W_G R_p + (W_\tau + W_G R_\tau) \tilde{\tau}'(p) \\ &= U_2(C) - U_2(N) + \mu' \tilde{\tau}'(p) r S_\tau \{ \tau \theta + p(\tau + f)(1 - \theta) \} \\ &\quad + \mu' (r S_p \{ \tau \theta + p(\tau + f)(1 - \theta) \} + r S \{ (1 - p)\tau - pf \} \theta_p + (\tau + f)(1 - \theta))\end{aligned}\tag{33}$$

use having been made of (8), (9), the properties of the revenue function in (16) and the first-order condition (25). Setting  $\widetilde{W}'$  to zero leads to a somewhat opaque characterisation of the optimal degree of evasion. Rather than pursue this, we focus on the central question of whether there exist circumstances in which, even when (22) is satisfied, the optimal degree of evasion is strictly positive. If there do, then — invoking our benchmark Proposition 1 for the full commitment case — an inability to commit to the tax rate provides a distinctive rationale for permitting evasion.

We therefore proceed by evaluating (33) at the borderline.<sup>23</sup> From (11) and (13), all but the middle term then vanish, leaving:

$$\frac{\mu'(G)}{U_2'(C)} = \left(1 + \frac{\tau S_\tau}{S}\right)^{-1}.$$

This is exactly analogous to the more familiar formula for the case in which it is labour income rather than capital income that is taxed, and has the same interpretation (see, for instance, Ballard and Fullerton (1992) and Wildasin (1984)). The right-hand side is the *ex ante* MSCPF; it differs from unity to the extent that behavioural responses affect the amount by which the tax rate must be raised — hence welfare reduced — in order to finance one more unit of the public good. On the other hand, when the government can renege, (30) implies the *ex post* MSCPF to be unity. Thus if, for instance,  $S_\tau > 0$ , then the *ex post* MSCPF exceeds the *ex ante* MSCPF — pointing towards a lower desired tax rate *ex post* than *ex ante* — the reason being that an increase in  $\tau$  is more productive of revenue when savings respond than when they do not.

<sup>22</sup>With the conventional empirical wisdom being that the intertemporal elasticity of substitution is less than one — see for instance Hall (1988), though others (such as Attanasio and Weber (1989)) reach a rather different conclusion — the case in which  $S_\tau > 0$  might seem the leading one to consider in the present model. In richer models, however, savings might plausibly decline with the tax rate even with an intertemporal elasticity below one: introducing a period 2 endowment, for instance, would bring in wealth effects that push towards  $S_\tau < 0$  (Summers (1981)).

<sup>23</sup>This is to be interpreted as a right hand derivative, the left hand derivative being zero.

$$\widetilde{W}' = r\tau\mu'\tilde{\tau}'(p)S_\tau. \quad (34)$$

Since  $r$ ,  $\mu'$  and  $\tau$  are all strictly positive<sup>24</sup> and the ambiguity of  $S_\tau$  has been discussed above, it remains only to consider the sign of  $\tilde{\tau}'(p)$ .

The sign of  $\tilde{\tau}'(p)$  indicates whether the equilibrium response to a reduction in the probability of detection is to raise or lower the tax rate that is implemented *ex post*. One might have expected that this could go either way. A reduction in  $p$  means, for a given level of savings, a smaller period 2 tax base. On one hand, this would seem to point towards a higher *ex post* tax rate in order to at least partially restore revenue. On the other, it would seem to point towards a lower tax rate in order to bolster the tax base both by encouraging fuller declaration of income (recalling from (14) that  $\theta_\tau < 0$ ) and (at least for  $S_\tau < 0$ ) by increasing equilibrium savings. One might thus have expected the structure of  $\tilde{\tau}'(p)$  to be complex, and its sign to be ambiguous. But this proves not to be the case. It is shown in Appendix C that, in the borderline case that is relevant in (34):

$$\tilde{\tau}'(p) = \frac{\mu'(\tau + f)rS\theta_\tau}{(1 - \phi_S S_\tau)\Omega_{\tau\tau}}. \quad (35)$$

From (14), the numerator of (35) is strictly negative. So too is the denominator, since the second-order condition for the period 2 problem (23) is that  $\Omega_{\tau\tau} < 0$  and the stability condition (28) implies that  $1 - \phi_S S_\tau > 0$ . In these circumstances the conclusion is unambiguous:  $\tilde{\tau}'(p)$  is strictly positive, so that the optimal response to a reduction in  $p$  is to lower the tax rate. Our central result is then immediate from (34):

**PROPOSITION 2:** *If the government cannot commit to the tax rate (and assuming a stable time consistent equilibrium), then it is optimal to facilitate some tax evasion if  $S_\tau < 0$ .*

The conclusion is strikingly sharp. All that is needed for some evasion to be optimal in the partial commitment case is that savings increase with the after-tax interest rate. And this, recall, is simply the condition for the validity in this model of the conventional presumption that the nature of the time inconsistency problem is to push the government into taxing capital income more heavily than it otherwise would. Other than stability, no substantive additional restrictions are required, and the result is in this sense as general as it could conceivably be.

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<sup>24</sup>The last of these follows from the assumption that the marginal utility of the public good is infinite at  $G = 0$ .

Note, in particular, that the condition  $S_\tau < 0$  for some evasion to be optimal when the government cannot commit to the tax rate is quite distinct from that (the converse of (22)) for some evasion to be optimal when it can commit. For the latter depends on the third derivative of direct utility whilst the former does not, pointing to the very different considerations at work. More specifically, it is not hard to find preferences for which there is no first-order gain from evasion in the full commitment case but for which there is such a gain in the partial commitment case. One very straightforward example is that in which relative risk aversion is constant and less than unity,  $U_2(X) = (1/(1 - \sigma))X^{1-\sigma}$  with  $\sigma < 1$ : it is easily verified that in this case (22) is satisfied and, from (12),  $S_\tau < 0$ .

It remains to develop the intuition for Proposition 2. Evasion proves desirable whenever the time consistent tax rate is ‘too high’ because, with  $\tilde{\tau}'(p) > 0$ , it reduces the tax rate that will prove *ex post* optimal once savings decisions have been made. It is the lack of ambiguity in this effect — the observation that the best *ex post* response to a little evasion is to lower the tax rate rather than raise it — which is perhaps the most striking of our findings, and which underlies the generality of Proposition 2. The explanation is not obvious, but seems to run as follows. Imagine that evasion is impossible, and suppose a time consistent tax rate is in place. Now consider the effects of inducing a little evasion. For reasons discussed earlier, private consumption and the equilibrium level of savings will both be unaffected. Under-reporting, however, means a contraction of the tax base. Hence public expenditure falls. The social marginal valuation of public expenditure thus rises above that of private consumption, pointing towards a policy response aimed at increasing revenue. As noted above, there are two ways in which one might think of doing this. One is by raising  $\tau$  in order to raise more from any given base.<sup>25</sup> The other is by lowering  $\tau$  in order to encourage fuller declaration and so expand the base. But the first of these was also an option in the initial situation, the government then balancing the welfare lost by raising the tax rate against the revenue gained; and since evasion has now eroded the tax base, the revenue gain is smaller than in the initial position, so that this option is unattractive. This leaves only the second option: that of lowering the tax rate.

## VI. Summary and Concluding Remarks

The purpose of this paper has been to argue that the evasion of taxes on capital income may serve a valuable and distinctive social purpose, complementary to those previously observed: it may be useful as a device for mitigating the classic time consistency problem that arises in taxing the return on savings. In the model used here, a government that is able to take measures which commit it to imperfect tax enforcement — training fewer tax inspectors, failing to maintain a register of taxpayers, tolerating

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<sup>25</sup>Since, as noted above,  $R_\tau > 0$  at an optimum.

bank secrecy laws abroad — will wish to do so whenever its inability to commit to the rate of capital income taxation forces it to charge a higher tax rate in the time consistent equilibrium than it would if it could commit to the tax rate. At its crudest, the intuition is straightforward: facilitating evasion enables the government to ‘tie its hands’, providing the private sector with an escape route from — and so reducing the incentive to impose — an *ex post* capital levy. This explanation, however, is a little too glib. The essential feature is that evasion lowers the *ex post* optimal tax rate; a less than obvious observation for which we sought to provide some intuition in the previous section.

Needless to say, our purpose has not been to suggest that commitment problems are the primary explanation for the existence of widespread evasion of taxes on capital income, nor that evasion is the only means by which governments can mitigate the potential time consistency problem in the taxation of capital income. It has simply been to establish a link between the two issues. Seeing evasion and commitment as related may prove fruitful, not least in understanding international tax relations and analysing current issues of coordination. It may ultimately point, for instance, to a useful social purpose for tax havens.

## APPENDICES

### A. Derivation of (12)–(15)

Perturbing (5) and (6) gives

$$\begin{bmatrix} V_{SS} & V_{S\theta} \\ V_{\theta S} & V_{\theta\theta} \end{bmatrix} \begin{bmatrix} dS \\ d\theta \end{bmatrix} = - \begin{bmatrix} V_{S\tau} & V_{Sp} \\ V_{\theta\tau} & V_{\theta p} \end{bmatrix} \begin{bmatrix} d\tau \\ dp \end{bmatrix}. \quad (\text{A.1})$$

Differentiating  $V_S$  in (5) with respect to  $\theta$  and  $p$ , for instance (and for later use), one finds:

$$V_{S\theta} = r\{pU_2'(C)f - (1-p)U_2'(N)\tau\} + rS\{pU_2''(C)(1+r_C)f - (1-p)U_2''(N)(1+r_N)\tau\} \quad (\text{A.2})$$

$$V_{Sp} = U_2'(C)(1+r_C) - U_2'(N)(1+r_N) \quad (\text{A.3})$$

which reduce at the borderline to:

$$V_{S\theta} = V_{\theta S} = 0 \quad (\text{A.4})$$

$$V_{Sp} = 0. \quad (\text{A.5})$$

Proceeding similarly for the remaining components of (A.1), evaluated at the borderline:

$$V_{SS} = U_1'' + U_2''(1+\bar{\tau})^2 \quad (\text{A.6})$$

$$V_{\theta\theta} = (f+\tau)(1-p)\tau(rS)^2U_2'' \quad (\text{A.7})$$

$$V_{S\tau} = -\{U_2'(\bar{C}) + U_2''(\bar{C})\bar{C}\}r \quad (\text{A.8})$$

$$V_{\theta\tau} = -(1-p)U_2'rS \quad (\text{A.9})$$

$$V_{\theta p} = (f+\tau)U_2'rS. \quad (\text{A.10})$$

Using (A.4) and (A.5), the solution to (A.1) simplifies to

$$\begin{bmatrix} dS \\ d\theta \end{bmatrix} = - \left( \frac{1}{V_{SS}V_{\theta\theta}} \right) \begin{bmatrix} V_{\theta\theta}V_{S\tau} & 0 \\ V_{SS}V_{\theta\tau} & V_{SS}V_{\theta p} \end{bmatrix} \begin{bmatrix} d\tau \\ dp \end{bmatrix}, \quad (\text{A.11})$$

so that, for example (and, again, later use)

$$S_\tau = -V_{S\tau}/V_{SS} \quad (\text{A. 12})$$

$$\theta_p = -V_{\theta p}/V_{\theta\theta} \quad (\text{A. 13})$$

The results follow on using (A.4) to (A.10) in (A.11).

## B. Derivation of (22)

The first step is to characterise the relative curvature shown in Figure 1. Differentiating the slope of an indifference curve in (19) with respect to  $p$  – and using, in particular,  $W_p = S_p = 0$  – one finds that the rate of change of the slope of an indifference curve at the borderline is:

$$\frac{d^2\tau}{dp^2}|_W = (f + \tau)\theta_p \quad (\text{B.1})$$

Similarly, differentiating the slope of the iso-revenue curve (20) and using  $R_p = S_p = 0$  together with (11) to evaluate it at the borderline gives:

$$\frac{d^2\tau}{dp^2}|_R = (f + \tau) \left( \frac{2\theta_p S - pS_{pp}}{S + \tau S_\tau} \right) \quad (\text{B.2})$$

The relative curvature shown in the diagram implies:

$$\frac{d^2\tau}{dp^2}|_W < \frac{d^2\tau}{dp^2}|_R \quad (\text{B.3})$$

Substituting from (B.1) and (B.2), and assuming that  $S + \tau S_\tau = R_\tau > 0$ , (B.3) is equivalent to the condition:

$$pS_{pp} < \theta_p(S - \tau S_\tau) \quad (\text{B.4})$$

Consider next  $S_{pp}$ . Solving (A.1) for  $S_p$  and differentiating with respect to  $p$  (taking account of the effects through  $S(p, \tau)$  and  $\theta(p, \tau)$ ) one finds, on using (A.13) and noting from (A.3) that  $V_{Spp} = 0$ , that at the borderline:

$$S_{pp} = \left( \frac{V_{\theta p}}{V_{SS}V_{\theta\theta}} \right) (V_{S\theta\theta}\theta_p + 2V_{S\theta p}) \quad (\text{B.5})$$

Substituting (B.5) into the left of (B.4), (A.12) and (A.13) into the right and multiplying through by  $(V_{SS}V_{\theta\theta})/V_{\theta p} > 0$  gives:

$$pV_{S\theta\theta}\theta_p + 2pV_{S\theta p} < -\tau V_{S\tau} - SV_{SS} \quad . \quad (\text{B.6})$$

Differentiating (A.2) with respect to  $\theta$  and evaluating at the borderline gives

$$V_{S\theta\theta} = r^2 S(pf^2 + (1-p)\tau^2)(2U_2'' + \bar{C}U_2''') \quad (\text{B.7})$$

and so, using (14), (15) and noting from (11) that at the borderline  $p^2 f^2 + (1-p)p\tau^2 = (1-p)\tau^2$ :

$$pV_{S\theta\theta}\theta_p = - \left( \frac{U_2'}{U_2''} \right) r\tau(2U_2'' + \bar{C}U_2''') \quad . \quad (\text{B.8})$$

Differentiating (A.2) with respect to  $p$  gives, at the borderline:

$$pV_{S\theta p} = r\tau(U_2' + \bar{C}U_2'') \quad (\text{B.9})$$

$$= -\tau V_{S\tau} \quad (\text{B.10})$$

from (A.8). Substituting (B.8) to (B.10) into (B.6), some rearrangement gives (22).

### C. Derivation of (35)

Differentiating  $\tilde{\tau}(p) = \phi[p, S(p, \tilde{\tau}(p))]$  and recalling (13), one finds that at the borderline:

$$\tilde{\tau}'(p) = \frac{\phi_p}{1 - \phi_S S_\tau} \quad . \quad (\text{C.1})$$

Implicit differentiation of the first-order condition (25), using (11) to simplify for the borderline case, gives:

$$\phi_p = \left( \frac{\mu'(\tau + f)\theta_p - \mu''\tilde{R}_p}{\Omega_{\tau\tau}} \right) rS \quad . \quad (\text{C.2})$$

Noting from (24) that  $\tilde{R}_p = 0$  at the borderline, (35) follows on substituting (C.2) into (C.1).

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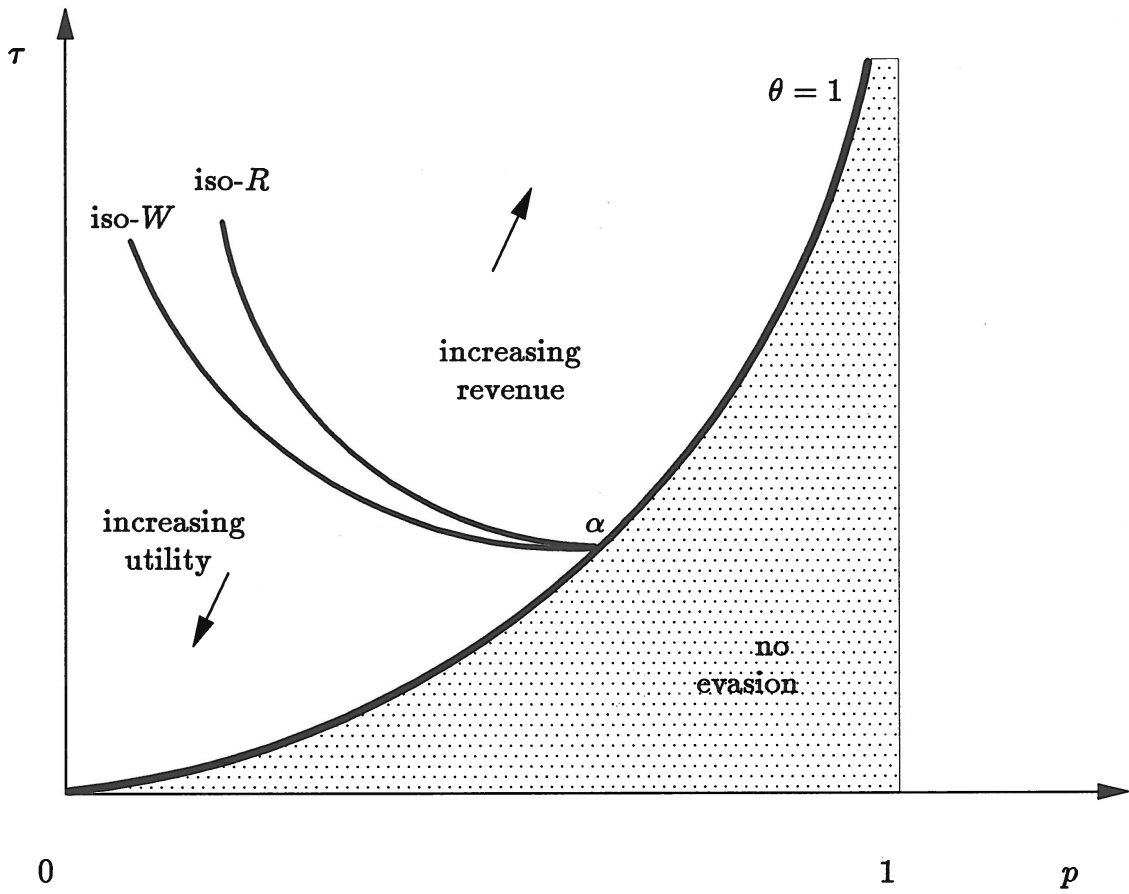


Figure 1