OPTIMAL TAXATION WITH COSTLY ENFORCEMENT AND EVASION

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ABSTRACT

This paper analyzes the relationship between optimal taxation -- where the literature considers raising revenue with minimum distortion -- and optimal tax enforcement -- where much of the literature emphasizes raising revenue at the least cost. A central question concerns the extent to which revenue should be raised through higher tax rates, which distort behavior, or greater enforcement, which distorts behavior because it raises marginal effective tax rates and also entails direct resource costs. It is demonstrated that, under each of several assumptions about evasion and enforcement, some expenditure on enforcement is optimal despite its resource cost, its distortionary effect, and the availability of other revenue sources having no enforcement costs. Rules for optimal tax rates and enforcement expenditures are derived, which also indicate the marginal cost of government funds and optimal enforcement priorities for a tax collection agency.

Optimal Taxation with Costly Enforcement and Evasion

Louis Kaplow*

The literature on optimal taxation considers how revenue can be raised in a manner that minimizes the distortion of behavior.[1] The literature on tax evasion tends to focus on individuals' compliance behavior without considering optimal enforcement or to examine optimal enforcement in a context that does not involve the distortions that have been emphasized in the study of optimal taxation.[2] This paper combines these traditions by analyzing the interdependency between optimal taxation and optimal enforcement.

A central question thus presented concerns the choice to be made between raising revenue through higher tax rates or greater expenditures on enforcement. Higher rates initially seem preferable, as enforcement directly consumes resources. Moreover, as with higher nominal rates, greater enforcement tends to distort behavior because it raises the marginal effective tax rate. This paper demonstrates, however, that raising tax rates and increasing enforcement typically do not cause the same degree of distortion; in the models presented, some expenditure on enforcement is optimal even when, ceteris paribus, enforcement increases distortion.

To illustrate the problem, consider whether one should raise tax rates or increase enforcement to finance a proposed government program. The only revenue source is an excise tax, currently at 10¢ per unit; enforcement costs

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1 See Anthony Atkinson and Joseph Stiglitz (1980), Agnar Sandmo (1976), Peter Diamond and James Mirlees (1971), F.P. Ramsey (1927). Although the models presented below do not incorporate distribution, the results, with appropriate modifications, would be applicable to models that did.

2 Literature emphasizing how evasion is determined began with Michael Allingham and Sandmo (1972) and Shlomo Yitzhaki (1974), and is summarized in Frank Cowell (1985). For work focusing on what audit policies maximize revenue or raise a given level of revenue at minimum budgetary cost, see Kim Border and Joel Sobel (1987), Jennifer Reinganum and Louis Wilde (1985). Those who address how optimal enforcement is affected by considerations in addition to effects on revenue and enforcement costs include Joram Mayshar (1988), Sandmo (1981), Joel Slemrod and Yitzhaki (1987), Dan Usher (1986), Yitzhaki (1987). They do not, however, model cases in which imperfect enforcement disrupts otherwise optimal marginal effective tax rates in a way that affects behavior in the manner studied here.

are 2¢ per unit and this enforcement achieves (in light of evasion) an *average* effective tax rate of 5¢. The needed revenue could be raised by increasing the nominal rate from 10¢ to 14¢ or by spending an additional 1¢ per unit on enforcement to achieve an average effective rate of 7¢. It might appear best to increase the tax rate, which involves no direct resource costs. But one also must consider the distortion that results from each alternative, which requires examining how evasion takes place. Suppose, for example, that a portion of the population knows that it is not observed by the government and thus is able to evade completely, while those observed comply fully. Increased enforcement allows more individuals to be observed; their behavior then would be distorted because they face an effective rate of 10¢ rather than 0¢. Increasing the nominal rate distorts behavior by causing already observed individuals to face a rate of 14¢ rather than 10¢. If distortion rises disproportionately with the marginal effective tax rate, increasing the nominal rate will be more distorting than increasing enforcement to raise the same additional revenue.

Thus, the optimal policy in this example involves some increase in enforcement expenditures despite the resource cost and distortion that results. Whether the new project should be funded depends upon whether its benefits exceed the social costs of raising the needed revenue, where such costs include the relevant incremental distortions from adjusting both tax rates and enforcement policy. The general conclusion is that optimal enforcement will be dictated not only by its direct resource cost and the revenue it raises, but by the distortion it causes, the distortion caused by increases in tax rates, and the marginal benefit of government expenditures. Optimal tax rates also will depend on all these factors. Furthermore, just as the choice between higher taxes and greater enforcement must reflect the relative distortion and not merely resource costs and revenue effects, so must the choice among enforcement options, as by a tax collection agency, reflect the relative distortion caused by each option and not merely the cost per dollar of revenue raised.

Section 1 presents a simple model of the familiar problem of optimal commodity taxation without enforcement costs. Sections 2 through 4 introduce a variety of enforcement problems. Section 2 incorporates the features of the preceding example as well as administrative costs. Section 3 considers evasion that consumes resources. Section 4 adds to section 3's model by including enforcement that increases the cost of evasion. The nature of the distortions introduced by evasion and caused by enforcement are different in each case, yielding different optimal tax rates and different optimal levels of enforcement. Remarks at the end of each section and in the conclusion interpret the results.

1. Optimal Taxation in the Absence of Enforcement Costs

The representative individual's decision problem is to maximize

$$(1) \quad U = \sum_{i=1}^{n} v_i(x_i) - v_o L + b(R)$$

over the x_i and L, with R taken as given, subject to the budget constraint

$$(2) \quad wL = \sum_i (p_i + t_i)x_i,$$

where

- U = representative individual's utility function
- x_i = quantity of good i consumed/purchased; there are n goods
- v_i = utility from consumption of x_i; $v_i' > 0$, $v_i'' < 0$
- L = amount of labor supplied
- v_o = a constant, representing marginal disutility of labor
- R = government revenue per capita, net of any enforcement costs
- b = utility from public good; $b' > 0$, $b'' < 0$
- w = wage
- p_i = producer price of x_i (given: constant marginal cost production)
- t_i = per unit tax on x_i.

Because this utility function is separable and linear in labor (leisure), income effects (and risk aversion) are eliminated and all cross-elasticities are zero.[3] The first-order conditions for the x_i and L reduce to

[3] Differentiating (3) with respect to t_j, for $j \neq i$, yields $dx_i/dt_j = 0$. That labor is untaxed is inconsequential, as it is familiar that a tax on labor

(3) $v_i' = \frac{v_o}{w}(p_i + t_i)$,

which states that the marginal utility for each good must equal its full price, weighted by the marginal utility of income, v_o/w. Differentiating the budget constraint (2) with respect to t_i yields

(4) $w\frac{dL}{dt_i} = (p_i + t_i)\frac{dx_i}{dt_i} + x_i$.

Using this information, one can now determine what tax rates maximize social welfare, taken to be the representative individual's utility (1), where government revenue per capita $R = \sum_i x_i t_i$ is now determined endogenously and the x_i and L are given by the solutions to the individual's maximization problem:

(5) $W = \sum_i v_i(x_i) - v_o L + b(\sum_i x_i t_i)$.

The first-order conditions can be expressed as[4]

(6) $\frac{t_i}{p_i+t_i} = \frac{\theta}{e_i}$,

where e_i is the elasticity of demand for good i and

(7) $\theta = \frac{b' - v_o/w}{b'}$.

That is, the less the elasticity of demand for a particular good, the greater will be the tax rate on it relative to that on other goods. In addition, the greater the extent to which the marginal benefit of the public good exceeds the marginal utility of income, the greater will be all the tax rates. This is the familiar Ramsey (1927) result for the optimal commodity tax problem in the case where there are no income or cross-price effects.[5]

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would be equivalent to an additional proportional tax on all commodities. That leisure, implicitly, is untaxed is critical; else, one has the familiar result that a nondistorting tax on endowment is possible.

[4] The first-order condition is

$$\frac{dW}{dt_i} = v_i'\frac{dx_i}{dt_i} - \frac{v_o}{w}\left((p_i+t_i)\frac{dx_i}{dt_i} + x_i\right) + b'\left(t_i\frac{dx_i}{dt_i} + x_i\right) = 0.$$

[5] The only difference is that a government revenue constraint is often used rather than explicitly modeling the use of that revenue as financing a public good that appears directly in the utility function. Because utility is a separable function of the public good and other goods (and labor), the result

2. Optimal Taxation with Enforcement Costs

Without loss of generality, assume that enforcement is perfect and costless with respect to all taxes except t_1, and consider two types of cost. First, evasion of t_1 can be prevented if and only if individuals are observed, and observation is costly. In particular, the portion observed α is a function of (per capita) *observation costs* c, where $\alpha' > 0$, $\alpha'' < 0$, and $\alpha'(0) = \infty$. Individuals know whether they are observed. Those observed face a tax rate on x_1 of t_1 (i.e., once observed, there is perfect enforcement), and their actions will be indicated using the notation of section 1's model. Those not observed face an effective tax rate on x_1 of 0, and their actions will be indicated using "~" in the notation.[6] Observe from (3) that, for $i \neq 1$, $x_i = \tilde{x}_i$ and $dx_i/dt_i = d\tilde{x}_i/dt_i$.

Second, there are (per capita) *administrative costs* $a(x_1, t_1, \alpha)$, where $\partial a/\partial x_1 \geq 0$, $\partial a/\partial t_1 \geq 0$, $\partial a/\partial \alpha \geq 0$. The assumption, therefore, is that it may be more costly to collect a tax the greater the volume of transactions, the higher the tax rate, and the greater the portion of transactions for which compliance is obtained.[7]

Social welfare is now given by

$$(8) \quad W = \alpha(c)\left[\sum_{i=1}^{n} v_i(x_i) - v_o L + b(R)\right] + (1-\alpha(c))\left[\sum_{i=1}^{n} v_i(\tilde{x}_i) - v_o \tilde{L} + b(R)\right],$$

where revenue (per capita) available to spend on the public good is

$$(9) \quad R = \alpha(c)x_1 t_1 + \sum_{i=2}^{n} x_i t_i - c - a(x_1, t_1, \alpha).$$

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here is no different, where b', the marginal utility of the public good per dollar expenditure, takes the place of the Lagrange multiplier on the government revenue constraint. See Atkinson and N.H. Stern (1974). Note also that in this model (and those in later sections), the ratio of the marginal rate of substitution to the marginal rate of transformation (of the public good to leisure) is simply $b'/(v_o/w)$, which equals $1/(1-\theta)$. See Don Fullerton (1989).

[6] This structure of enforcement corresponds roughly to some instances where information reporting is used in conjunction with income taxes, with the simplification that those not observed in this model face no risk rather than a low risk of detection.

[7] A. Mitchell Polinsky and Steven Shavell (1982) consider how similar administrative costs affect the optimal level of a Pigouvian tax.

The first-order conditions for t_i, $i \neq 1$, are the same as with costless enforcement (6). The first-order condition for t_1 is

$$(10)\quad \frac{t_1 - \frac{1}{\alpha}\cdot\frac{\partial a}{\partial x_1}}{p_1+t_1} = \frac{1}{e_1}\left(\theta - \frac{1}{\alpha x_1}\cdot\frac{\partial a}{\partial t_1}\right).$$

Aside from administrative costs a, this condition is equivalent to that for the case of costless enforcement (6).[8] The first-order condition for c is

$$(11)\quad \frac{dW}{dc} = \alpha' U - \alpha' \tilde{U} + b'\frac{dR}{dc} = 0, \text{ or}$$

$$(12)\quad \alpha'(c) = \frac{b'}{(U-\tilde{U}) + b' x_1 t_1 - b'\frac{\partial a}{\partial \alpha}}.$$

Interpretation -- Observation Costs (c)

This section considers the effects of observation costs where administrative costs (a) are zero, except as otherwise noted.

(1) *Higher tax rates.* Because only α of the population pays the tax on x_1 and enforcement costs must be borne, there would be less expenditures on the public good than in the case of perfect, costless enforcement if tax rates were unchanged. As a result, the marginal benefit of public expenditures, b', would be higher, so all the optimal t_i -- including i=1 -- are higher, and, loosely speaking, by roughly the same proportion.[9]

(2) *Decreased expenditures on the public good.* Despite the higher tax rates, the optimum will nonetheless involve less expenditures on the public good than if enforcement were costless, because the marginal cost of raising revenue is greater.[10] (Whether gross revenue -- that is revenue gross of enforcement costs -- is higher or lower cannot generally be determined.)

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[8] Note that e_1 in (10) refers to the elasticity for the group that is observed and thus pays the tax; this elasticity may differ from that for the other group, which consumes a higher level of x_1.

[9] See (6) and (10) -- these are the same in the absence of administrative costs -- and recall from (7) that θ is increasing in b'. The proportions will not be the same only because the higher t_i in this problem entail different x_i, so the e_i may differ as well.

[10] If the optimum did not entail less expenditures, b' would not be higher, so tax rates could not be higher, a contradiction.

(3) *Expenditures on enforcement*. It is worthwhile to spend some resources on enforcement, which is costly in terms of real resources, in order to effect a "transfer" that could have been accomplished by raising tax rates rather than incurring enforcement costs. The intuition is that, at c =0, the problem is the Ramsey tax problem of section 1 subject to the constraint that $t_1 = 0$. Relaxing the constraint that individuals are exempt from the tax on good one subjects them to the average distortion caused by the optimal t_1; raising the same revenue through higher tax rates affects the marginal distortion, which is greater. In total, then, it is optimal to respond to this enforcement problem by adjusting at all margins: raising the tax rate on the good in question and on all other goods, decreasing expenditures on the public good, and spending some resources on enforcement. How much of the response will take the form of expenditures on enforcement depends, from (12), on four factors:

- The higher is b', the more should be spent on enforcement. (Note: one also should raise tax rates more. The only thing one should do less of is cutting expenditures on the public good.)

- The greater is x_1t_1 -- that is, the more revenue one obtains from the tax on x_1 -- the more should be spent on enforcement. (At the margin, increases in enforcement will buy more of the public good and/or more of a reduction in distorting tax rates.)

- The greater is the difference in utility between the two groups -- $U-\tilde{U}$ -- the less should be spent on enforcement. The difference $U-\tilde{U}$ (which is negative) consists of two components. First, those subject to t_1 pay additional taxes equal to x_1t_1; given that the marginal utility of income, v_o/w, is less than b' at the optimum, the revenue effect described with regard to the preceding factor dominates. Second, utility is lower because consumption choices are further distorted. Thus, for a given level of revenue raised by the tax, a greater difference in utility between the two groups implies a greater distortion, and thus less value from relaxing the constraint that exempts some individuals from having to pay t_1.

- The greater is the increase in administrative costs *a* as enforcement increases, the less should be spent on enforcement.

These factors similarly dictate enforcement priorities: if more than one tax were subject to this enforcement problem, (12) indicates how enforcement resources should be allocated, and the following remark explains how this differs from an enforcement policy designed to maximize revenue rather than to maximize welfare.

(4) *Revenue maximization compared.* The revenue-maximizing c is given by

$$(13)\quad \alpha'(c) = \frac{1}{x_1 t_1 - \frac{\partial a}{\partial \alpha}}.$$

As is clear from (11), (13) differs from (12) in not counting the utility loss $(U-\tilde{U})/b'$, consisting of the payment of revenue and the distortionary effect of t_1. As a result, revenue maximization entails greater enforcement expenditures. Focusing exclusively on the maximization of net revenue through enforcement policy ignores other relevant policy margins: the level of expenditures on the public good, which should be reduced in light of enforcement costs; tax rates (both on x_1 and on other goods), which should be raised; and expenditures to reduce evasion of other taxes.

Interpretation -- Administrative Costs (a)

(1) *Tax rates.* To the extent expenditures on the public good are reduced (whether this is the case is discussed below), tax rates on all goods will tend to be higher because b′ is higher. In addition, for good one, there are two effects due to administrative costs on the optimality condition (10). On the left-hand side, the effect is that t_1 will tend to be higher to the extent administrative costs are affected by x_1 (because higher rates reduce consumption and thus administrative costs). On the right-hand side, the effect is that t_1 will tend to be lower, to the extent that higher rates imply higher administrative costs. Consider two special cases. First, assume $a(x_1,t_1,\alpha) = a(x_1 t_1 \alpha)$. In this instance, (10) reduces to

$$(14)\quad \frac{t_1}{p_1+t_1} = \frac{\hat{\theta}}{e_1},$$

where

$$(15)\ \hat{\theta} = \frac{b'(1-a') - v_o/w}{b'(1-a')}.$$

The direct effect of higher administrative costs implies lower tax rates.[11] Second, assume $a = a_1 \alpha x_1$, where a_1 is a constant. Now there is only the left-hand-side effect, so t_1 would be higher than otherwise.

(2) *Expenditures on the public good.* It might appear that the optimal level of expenditures on the public good -- revenue net of administrative costs -- is necessarily lower due to administrative costs, because the total cost for any level of net revenue is higher than with perfect, costless enforcement. This reasoning, however, is incomplete because it is the *marginal* cost of net revenue that is relevant, and that may be lower. If the left-hand-side effect in (10) dominates, a higher t_1 is optimal, and, if this effect is large in the relevant range, the additional revenue from the higher t_1 may exceed the full administrative costs.

(3) *Whether a good should be taxed.* It may be optimal not to tax a good due to administrative costs. Consider the example in (14) and (15) above: It would be optimal not to tax x_1 only if, at $t_1 = 0$,

$$(16)\ a' \geq \theta.$$

This condition is not sufficient; one would have to determine directly whether there existed an interior local optimum tax rate that was superior to not taxing the good.[12]

3. Optimal Taxation with Evasion Costs

As with the model in section 2, enforcement with respect to the first good is imperfect: only α of the population is observed and subject to perfect enforcement; all others bear no tax on the first good. Assume, however, that

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[11] Administrative costs can fall as t_1 increases only if revenue is falling, but it would never be optimal to set t_1 in that range. Of course, if b' is greater due to administrative costs, the overall effect on t_1 is still ambiguous.

[12] If there were fixed administrative costs, it also may be optimal not to tax a good. See Yitzhaki (1979).

whether individuals are observed is determined by their expenditures on evasion rather than by the level of enforcement. (Section 4 combines enforcement and evasion activity.) In particular, an individual completely evades t_1 if and only if he spends $h(\gamma)$ to hide his activity, where $h_\gamma > 0$ and c refers to the individual's type, distributed according to $f(\gamma)$ on $[0,\infty)$. That is, individuals are ordered by γ according to the amount they must spend to evade the tax.[13]

Consider first the individual's maximization problem. With the utility function as in (1), the only effect on individuals' behavior is that those who choose to evade will increase their labor supply, relative to the level in section 2's model for those not subject to t_1, by $h(\gamma)/w$ -- just enough to cover the evasion cost. Thus, individuals evade if and only if

$$(17)\quad \frac{v_o}{w}h(\gamma) \leq \tilde{U} - U,$$

where, as in section 2, U is the utility of individuals who bear t_1 and $\tilde{U}$ is the utility of individuals who are not detected, *the latter defined here to be the utility without deducting evasion cost h.* (This is for convenience: all individuals who evade have the same $\tilde{U}$, although they generally have different levels of h and thus different levels of labor supply.) Define $\gamma*$ as the type who is just indifferent to evasion, for whom (17) holds as an equality. The portion who comply is

$$(18)\quad \alpha = 1 - \int_0^{\gamma*} f(\gamma)d\gamma.$$

Social welfare is now given by

$$(19)\quad W = \alpha U + (1-\alpha)\tilde{U} - \frac{v_o}{w}\int_0^{\gamma*} h(\gamma)f(\gamma)d\gamma.$$

The latter term is simply the total resources expended on evasion, weighted by the marginal utility of income. Revenue available to spend on the public good is

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[13] Expenditure h may be interpreted as the cost of structuring one's x_1 transactions to evade detection or as a (psychic) utility cost to breaking the law, where individuals vary in the value they place on compliance with the law for its own sake.

$$(20)\quad R = \alpha x_1 t_1 + \sum_{i=2}^{n} x_i t_i.$$

The first-order condition for the optimal level of t_1 can be expressed as[14]

$$(21)\quad \frac{t_1}{p_1+t_1} = \frac{\theta - \dfrac{x_1 t_1 f(\gamma^*)}{\alpha h_\gamma(\gamma^*)}}{e_1}.$$

Interpretation

(1) *Direct effect of evasion on optimal* t_1. Compare (21) and (6): Increasing t_1 increases evasion, which reduces revenue relative to what it otherwise would be. As a result, the optimal t_1 will be lower than otherwise

- the greater the rate at which evasion increases as the tax rate increases (expressed as $f(\gamma^*)/h_\gamma(\gamma^*)$),
- the greater the revenue raised per individual subject to the tax ($x_1 t_1$) and thus the more revenue that is lost as more evade, and
- the less the portion of individuals who are subject to the tax (α). (This last factor arises because increasing the tax rate increases revenue with respect to α of the population while losing revenue in an amount determined by the evasion response rate $f(\gamma^*)/h_\gamma(\gamma^*)$, the latter being independent of α.)

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[14] The first-order condition is

$$\frac{dW}{dt_1} = \alpha\frac{dU}{dt_1} + (1-\alpha)\frac{d\tilde{U}}{dt_1} + \frac{d\alpha}{dt_1}(U-\tilde{U}) - \frac{v_o}{w}h(\gamma^*)f(\gamma^*)\frac{d\gamma^*}{dt_1} = 0.$$

Individual optimization implies that the third and fourth terms offset. Using the same substitutions as in section 2's model, one has

$$\frac{dW}{dt_1} = -\alpha\frac{v_o}{w}x_1 + b'\frac{dR}{dt_1} = 0,$$

where

$$\frac{dR}{dt_1} = \alpha(x_1 + t_1\frac{dx_1}{dt_1}) + x_1 t_1\frac{d\alpha}{dt_1}.$$

Differentiating (17) (with equality for the marginal type) and (18), $d\alpha/dt_1 = -f(\gamma^*)x_1/h_\gamma(\gamma^*)$.

(2) *Effects of evasion on expenditures on the public good and on the level of optimal tax rates*. First, if tax rates were as in the case of perfect, costless enforcement, there would be less revenue due to the fact that only α of the population pays t_1. Second, the fact that evasion increases with t_1 suggests that a lower t_1 than otherwise is optimal, as just noted. Both effects imply less revenue available for the public good and thus a higher b'. This, in turn, indicates that optimal tax rates will be higher. For t_1, of course, there is also the countervailing direct evasion effect.

4. Optimal Taxation with Evasion and Enforcement Costs

Extend the model of section 3 by adding enforcement costs. In particular, assume that the cost of evasion for an individual of type γ is $h(\gamma,c)$, where $h_\gamma > 0$ as before, c is the per capita enforcement expenditure, and $h_c > 0$, $h_{cc} < 0$.

The individual's maximization problem, in which the level of enforcement c is given, remains as in section 3. The social maximization problem differs in that revenue available for the public good is reduced by c and c is now a choice variable in addition to the t_i. For any level of c, the condition for the optimal level of t_1 is as before (21) -- and the conditions for the optimal t_i, $i\neq 1$, continue to be as in (6). The first-order condition for the level of enforcement is

$$(22)\quad \frac{dW}{dc} = \alpha\frac{dU}{dc} + (1-\alpha)\frac{d\tilde{U}}{dc} + (U-\tilde{U})\frac{d\alpha}{dc} - \frac{V_o}{w}h(\gamma^*,c)f(\gamma^*)\frac{d\gamma^*}{dc} - \frac{V_o}{w}\int_0^{\gamma^*} h_c(\gamma,c)f(\gamma)d\gamma = 0.$$

The third and fourth terms offset, as the type who is just indifferent with respect to evasion will have equated the evasion cost and utility gain from evasion. Because c affects U and $\tilde{U}$ only through its effect on R, the first two terms sum to $b'dR/dc$, so one can write[15]

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[15] Because $\tilde{U}$, the utility of those who evade, is defined without deducting evasion costs h, the only effect of c is through R. $dR/dc = x_1t_1d\alpha/dc - 1$. From (18), $d\alpha/dc = -f(\gamma^*)d\gamma^*/dc$. From (17), holding with equality for the marginal type, $d\gamma^*/dc = -h_c(\gamma^*)/h_\gamma(\gamma^*)$.

$$(23)\quad h_c(\gamma^*) = \frac{h_\gamma(\gamma^*)}{f(\gamma^*)} \cdot \frac{b' + \Phi}{b' x_1 t_1},$$

where Φ denotes the fifth term in (22).

Interpretation

(1) *Tax rates and expenditures on the public good.* As already noted, the formulation for the optimal tax rates is the same as in the case with evasion only. Of course, enforcement costs leave less net revenue for the public good for a given set of tax rates (and a given level of evasion), implying a higher b' and thus higher tax rates (but still, ultimately, less expenditures on the public good) than if the same level of compliance were achieved with no enforcement costs.

(2) *Expenditures on enforcement.* In determining the optimal level of expenditures on enforcement from (23), one notes that the optimal level of enforcement is higher

- the greater is b', the marginal benefit of expenditures on the public good,
- the greater is x_1t_1, the revenue on good one per person paying the tax,
- the lower is Φ, the increase in expenditures on evasion by those who continue to evade, weighted by the marginal utility of income, and
- the greater is $f(\gamma^*)/h_\gamma(\gamma^*)$, the rate at which evasion responds to changes in enforcement.

Compare these effects to the result in section 2's model (12) in which the fraction of the population observed depended only on the level of enforcement. The first two effects are analogous: a higher marginal benefit of the public good and greater revenue per person complying with the tax on good one imply that more enforcement is optimal. (12), unlike (23), had in the denominator the term $U-\tilde{U}$, indicating the welfare loss to those individuals who bear t_1 as a result of increased enforcement. This term does not appear in (23) because it was offset (in (22)) precisely by the expenditure such individuals no longer make in evading the tax. That is, the marginal type of individual, who by definition was just indifferent as between complying and evading, does not suffer a decline in utility from a small increase in enforcement that induces compliance rather than evasion. Instead, in (23) there appears Φ, the inframarginal effect on those individuals who continue to evade but at higher cost.[16]

(3) *Effect of enforcement on distortion.* Individuals who, at the margin, become subject to t_1 suffer a loss in utility $(U-\tilde{U})$ that precisely offsets their savings in evasion costs h. The utility loss consists of the distortionary effect of being subject to the tax on good one and the tax payment on good one. The latter involves the substitution of revenue collected for the previous expenditure of resources on evasion. As a result, enforcement decreases distortion with respect to marginal individuals. But enforcement increases distortion through its effect on the inframarginal cost of evasion Φ. Either the marginal or inframarginal effect on total distortion could be greater. Similarly, considering the resource costs of evasion alone, either the marginal or inframarginal effects -- captured in the fourth and fifth terms in (22) -- could be greater.

(4) *Revenue maximization compared.* The condition here is

$$(24)\quad h_c(\gamma^*) = \frac{h_\gamma(\gamma^*)}{f(\gamma^*)x_1 t_1}.$$

Revenue maximization differs from welfare maximization (23) by not counting the inframarginal evasion costs (Φ), just as in section 2 (13) it did not consider the loss in utility due to added compliance $(U-\tilde{U})$.

5. Concluding Remarks

This paper has examined how the revenue and distortion produced by a tax system is influenced by tax rates, evasion opportunities, and enforcement policy. In the first model, increased enforcement, by increasing the

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[16] Of course, there is no analog in (12) to the effect in (23) concerning the rate at which individuals comply when enforcement expenditures increase the cost of evasion.

effective tax rate on some individuals, increased the distortion, ceteris paribus -- in addition to consuming resources. Despite these costs and the availability of other revenue sources for which enforcement was perfect and costless, some enforcement improved the efficiency of taxation. The the distortion from increasing the effective tax on the good by increasing enforcement was less than the loss associated with raising added revenue from higher taxes on that good or on other goods. In the second model, where evasion consumed resources, the tax was more distorting than otherwise due to the evasion it induced. Enforcement, by making evasion more costly, reduced evasion and thus increased revenue. But enforcement did not unambiguously reduce the total resources expended on evasion and did increase distortion by subjecting more individuals to the tax. The effect of enforcement on total distortion was indeterminate, but, even if enforcement increased distortion, some expenditures on enforcement were optimal. The conditions in each model also are useful because they constitute welfare maximizing enforcement priorities for a tax collection agency that must allocate scarce resources to address multiple compliance problems, and indicate how such priorities differ from those implied by revenue maximization.

An important implication of these models is that the optimal response to problems of enforcement involves action at many margins. (1) Typically, less should be spent on government programs than otherwise (although gross revenue -- including enforcement expenditures -- may be higher). (2) The tax rate(s) on the good(s) for which enforcement is imperfect should be adjusted. In the first model, the adjustment for enforcement costs was upward reflecting the greater marginal benefit of the public good when less is to be produced, while administrative costs, depending on their structure, could lead to higher or lower rates. In the second model, in addition to the upward effect from the greater marginal benefit of the public good, there was also the downward effect due to the fact that higher tax rates increased evasion. (3) Imperfect enforcement of one tax usually makes increasing other taxes desirable, because of the greater marginal benefit of revenue to spend on government programs when less net revenue is obtained due to imperfect or costly enforcement. (4) Often, some resources should be devoted to enforcement, which entails direct resource costs, rather than simply raising tax rates, even when enforcement increases distortion. One might add, of course, a fifth instrument not considered in this investigation or most others: The penalty structure affects revenue, the distortionary effect of taxes, and the marginal cost of obtaining compliance for any given tax structure and level of expenditures on enforcement. Future work must integrate this instrument as well.

These conclusions suggest that determining optimal enforcement policy is more complex than it first might have appeared. Even the handful of illustrations analyzed here -- which represent quite a narrow sampling from the broad range of enforcement problems and tax structures that exist[17] -- demonstrate that there is no single tax enforcement problem. In any particular context, enforcement may be more or less desirable than suggested by simpler formulations. Moreover, optimal tax rules and measures of the efficiency cost of raising government revenue generally will differ in the presence of evasion and enforcement costs. Future investigations of the optimal choice among tax systems thus should take more account of compliance problems, the nature and magnitude of which will vary greatly from one system to another.

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[17] The simple commodity tax model employed here can readily be modified to incorporate a variety of other evasion and enforcement problems. For example, if individuals evade t_1 perfectly, but only with respect to some of their expenditures on x_1, where the cost of evasion is an increasing function of the amount of x_1 hidden and of the level of government enforcement expenditures, one obtains results analogous to those in Usher (1986): the optimal t_1 is lower due to the evasion induced by raising the tax rate, and optimal enforcement involves equating the marginal increase in evasion costs (weighted by the marginal utility of income) with the marginal increase in net revenue (weighted by the marginal benefit of the public good). In this special case, enforcement affects revenue and private evasion costs but does not alter the marginal effective tax rate. This model, as well as others one can construct, may incorporate probabilistic enforcement determining evasion costs or effective tax rates. Once probabilistic enforcement is introduced, familiar effects from risk aversion arise. See Slemrod and Yitzhaki (1987). In addition, by allowing for the penalty per unit of evasion to be a function of the amount of evasion, there exist straightforward models in which (1) increased enforcement increases revenue and produces no deadweight loss and (2) increasing the tax rate is a perfect substitute for enforcement with respect to their effects on revenue and distortion, making higher rates a strictly preferred choice (i.e., optimal enforcement expenditures are as close to zero as possible).

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